YOUR

COMMODORE

OCTOBER 1988 £1.20

IRREGULAR ADD-ONS
a round-up of unusual accessories

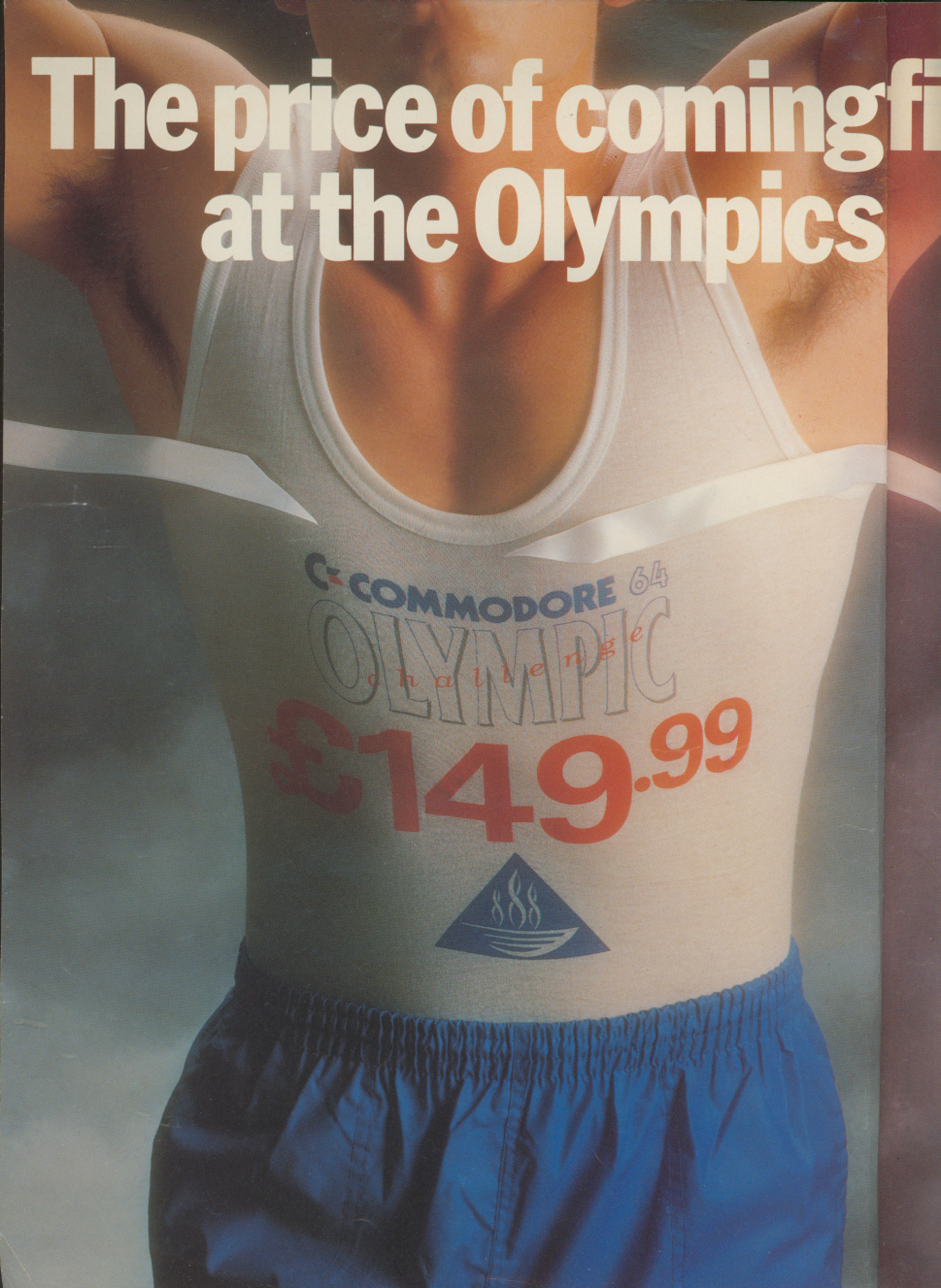
Games Reviewed:
Dark Side
Football Manager II
The Games–Winter Edition
Netherworld
Fernandex Must Die



Alarm—programmer's time out

UNBEATABLE PROGRAMS:

JOYSTICK CURSOR ☐ FILE EXTENSION ☐ HI-RES FILL ☐ CODE RELOCATION


The price of coming fi
at the Olympics
COMMODORE 64
OLYMPIC
challenge
£149.99

gfirst
s

If you weren't selected for the Seoul Olympics, no need to feel out of the running.

Because everything you need to compete in all the events is right here with the Commodore 64 Olympic Challenge pack. And at only £149.99, your gold medal's practically in the bag.

Here's the C64 Olympic line-up...

* **C64 Computer, the latest version of the world's best-selling computer.**
* **Cassette unit, for simple loading of programs.**
* **Joystick to put you in complete control of screen action.**
* **Plus all the excitement of 10 great sporting games.**

On day one, you can use all your skills and reflexes to race against the clock in the track and field events. Or take up the challenge of world series baseball, weightlifting, football, tennis and the championship title fights.

And when the Olympics are over, you can then go out and grab the best beat 'em ups, one-on-one, adventure and simulation games that really come alive on the C64.

There's only a few days to go before the opening ceremony, so make a dash for your local dealer and ask about the C64 Olympic Challenge pack. Or telephone 0800 800 477 for more details.



Commodore



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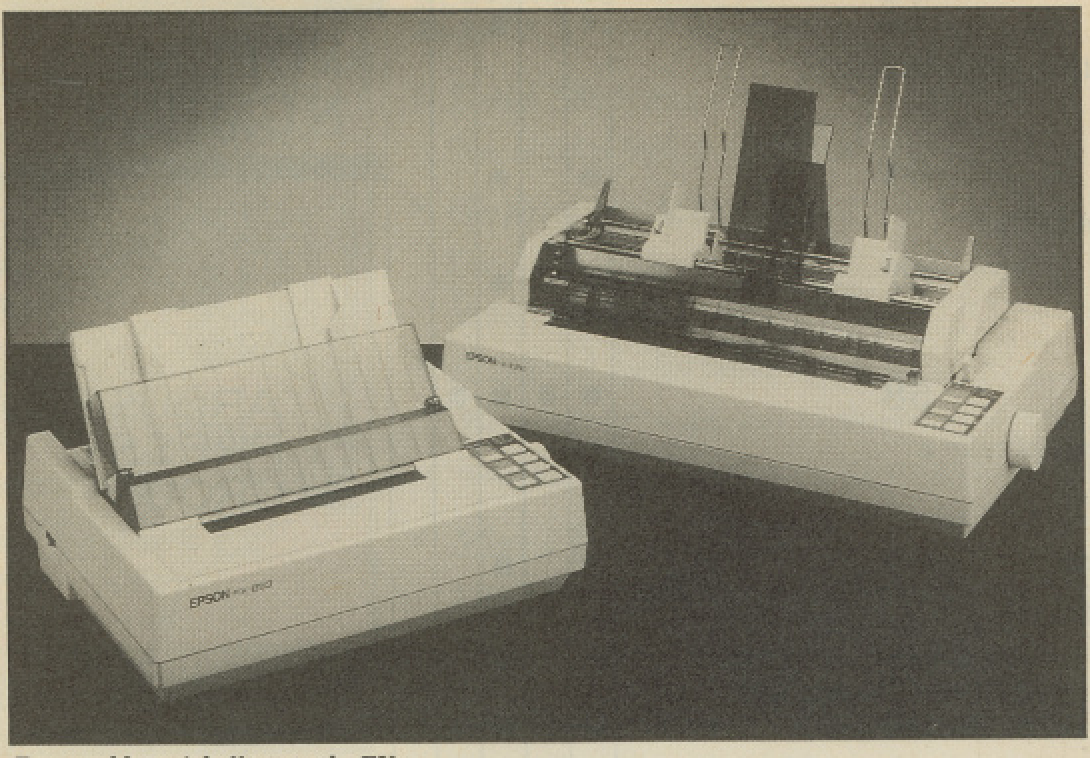
Football Manager II

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Epson add special effects to the FX

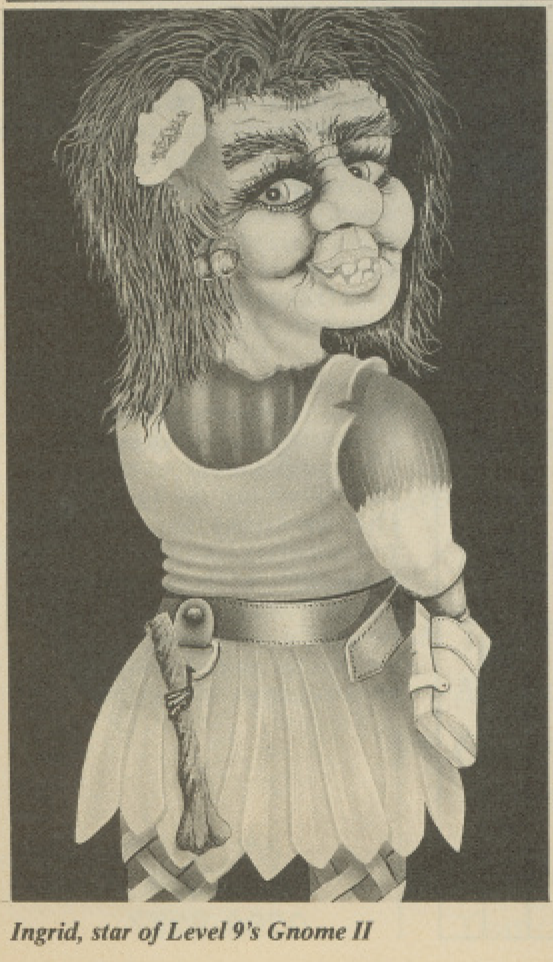
FX Parking Permit

The Epson FX850 and FX1050 printers have been upgraded to incorporate a paper parking facility.

The new units, which retail at £459 and £599 respectively, can now be used with a minimum of fuss when continuous stationery is swapped for sheet feeding. Instead of unlacing the tractor feed manually, new owners can just flick a lever and press a switch. The actions automatically withdraw the paper out of the printer's paper path but the tractor sprocket remains engaged. This means that, after the sheet feeding has been completed, tractor feed can be resumed without the need to relace the paper by hand.

The machines also feature three internal character fonts, 246cps draft and 54cps NLQ speeds, all done with less than 55dBA of noise.

Touchline: *Epson (UK), 388 High Road, Wembley, Middlesex HA9 6UH.* **Tel:** *01-902 8892.*



Ingrid, star of Level 9's Gnome II

Level Gnome

At Level 9, Gnome is where the heart is and to prove it Ingrid's Back. The diminutive star of Gnome Ranger returns to battle against Jasper Quickbuck in Gnome II.

Quickbuck is planning a Yuppie Homes development in a quiet corner of the gnome counties. Only one thing stands between him and his dreams of suburbia — Ingrid Bottomlow and her accident prone ways.

Also nearing completion is Pete Austin's megaproject Lancelot. After months of research, Austin has combined hi-tech programming with Mallory's Morte D'Arthur to produce a three part adventure which follows Lancelot's knighting, his fall from grace with Guinever and the search for the Holy Grail.

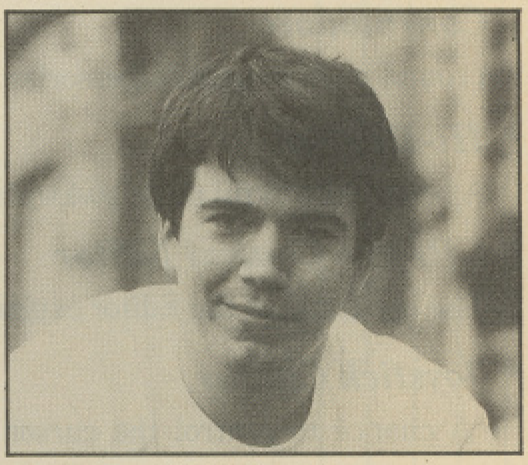
Touchline: *Level 9, 5 Mendip Road, Crown Wood, Bracknell, Berkshire RG12 3XG.* **Tel:** *0344 487597.*

Arts Trek

Electronic Arts are releasing the 'Wargame of the Century' and its simply called Empire. The objective is to search out alien lifeforms and blast them to bits.

This may sound like a corruption of Star Trek so far but there's more. The player takes the roll of Captain William P Brown of the UGAS Britannia, an enterprising chap who wishes to seek out the evil Krellans who cling on to large tracts of real estate known as the Krellan Empire.

William P Brown has to boldly go into the heartlands of the Krellans, completely phase them into submission and escape scot free as he checks off another conquered world, leaving bare bones and shouting a battle cry of 'Ooh, hurrah!' at the death of the Krellans. Then, realising that he spoke too soon, he heads off into uncharted space to do battle once more.



Michael Powell EA's first UK programmer

Empire is a one to three player game of strategy in which the winner is the last to survive.

The second up and coming release from EA is Powerdrome which has the distinction of being the first EA game to be penned entirely in the UK.

This November launch for the Amiga features solid 3D graphics of a jet racer championship of the future. The Powerdrome series consists of six races, each at different tracks which feature differing weather conditions.

A special feature is included in the two player game which requires two Amigas to be linked together. Once the union is made, the two combatants can race against each other after tuning up and getting a suspensor grid position through speed trials at the start of the race.

Touchline: *Electronic Arts, 11-49 Station Road, Langley, Berkshire SL3 8YN. Tel: 0753 49442.*

Gung Ho Prose

Glasnost is a word which doesn't appear to feature in Wild Bill Stealey's vocabulary down at Microprose HQ. Once more it's time to loose the dogs of war on the Commie threat as Red Storm Rising makes a transition from book to game.

Tom Clancy's best seller concerns events in a future world war between the Russians and Americans in which a lone nuclear submarine has the task of wiping out the USSR's underwater fleet.

Microprose's leading programmer and designer, Steve Meier, has been given the task of converting words into bytes. Meier promises that the new simulation will be far more advanced than Microprose's highly acclaimed Silent Service.

In the meantime, the PC Show's centrepiece was provided by Microprose in the form of a highly advanced simulation machine. The Super X Prokon flight simulator combines sensitive mechanical control with a wide angle computer generated visual display to give its 14 passengers the sensation that they're really flying.



Microprose's PC Show stopping Super X flight simulator

Touchline: *Microprose, 2 Market Place, Tetbury, Gloucester GL8 8DA.* **Tel:** *0666 54326.*

Vive la micro

The French are preparing for their second Festival de la Micro show on 14-16th of October at Espace Champerret, Paris. This is only the second year that the show has been held but it is rapidly establishing itself as the Gallic equivalent to the PC Show.

The festival is hosted by Neo Media press group and it was developed through necessity rather than by design. Neo Media organised an Amstrad show in 1986. It proved so successful that Amstrad France decided to run the show themselves by registering the name Amstrad Expo and forbidding Neo Media from using the Amstrad name.

Jean Kaminsky, Neo Media's managing director and show organiser, was not deterred so easily and in October last year the Festival de la Micro attracted over 20,000 visitors. Apple, Atari, Amstrad, Commodore and Sega all took stands at the show and they will also be there again this year.

The only question that remains is whether Amstrad will be the biggest draw again this year or will Commodore or Atari pull the larger share of the crowd?

Touchline: *Festival de la Micro, Espace Champerret, Porte de Champerret, Paris*
Organiser: *Neo Media, 5-7 Rue de l'Amiral Courbet, 94160 Sainte Mande.*

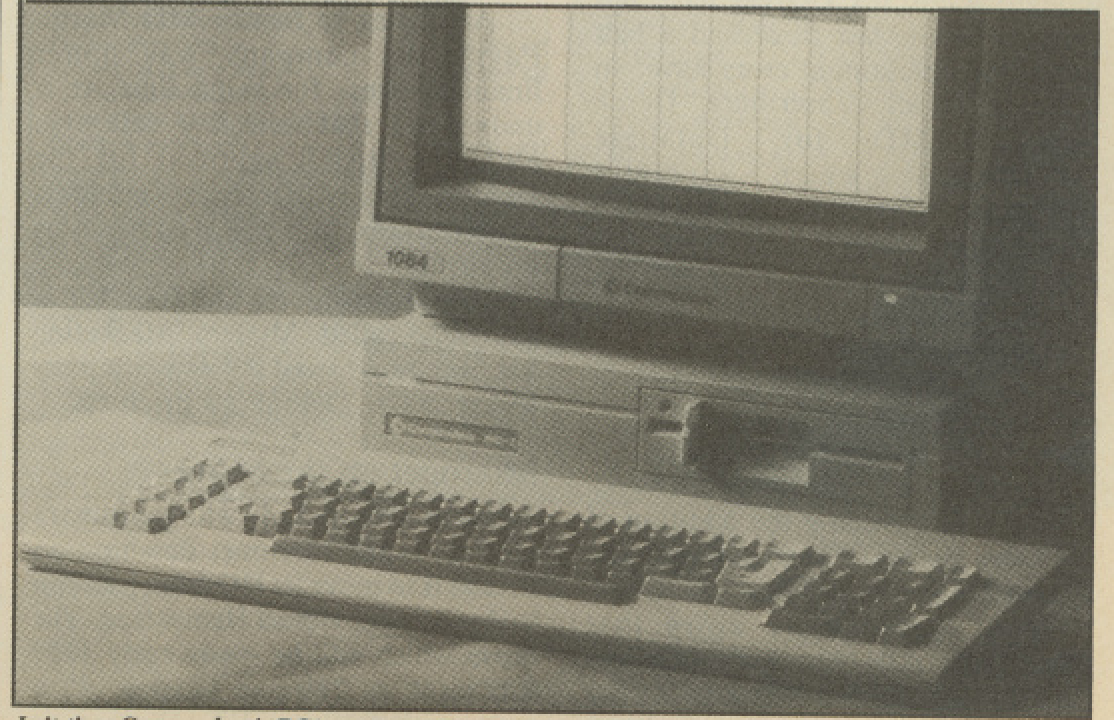
PC Plod

Commodore are to be commended for sticking with their PC compatibles and at last persistance may be paying off. With their prices at an all time low, the company is now promoting its discount schemes for educational establishments.

Under the scheme, PC1s retailing at £315 (mono) and £430 (colour) are being supplied for £299 and £369 respectively. At the top end of the range the savings are even greater with PC60-80HD Enhanced Colour Display 80386 clone costing £4299, a saving of £1160 on the normal RRP.

Now that prices have come down so far, it could be time for schools to re-examine their microcomputer policies with a thought to using the industry standard PC instead of the charming but remote BBC Micro. The fact that the PC is used in almost every computerised establishment would give the computer student a distinct advantage in gaining employment when cast from the academic world into that of commerce.

Touchline: *Commodore Business Machines (UK) Ltd, The Switchback, Gardner Road, Maidenhead, Berkshire SL6 7XA.* **Tel:** *0628 770088.*



Is it time Commodore's PC1 went to school?

COMMUNICATIONS CORNER

Our roving reporter David Janda is back with more news and views in the world of comms

One major problem associated with calling bulletin boards is the cost of the call. Not only that, but many BB numbers published in magazines and on BB's do not state the location of the BB itself.

A new facility available to MicroLink subscribers can now solve that problem. Called STD, users either enter the name of a town/city, or a dialing code and the exclusive of the two will be displayed.

As an example, entering '0424' will result in 'Hastings' being displayed. Alternatively, entering 'Hastings' will result in '0424' being displayed.

At the time of writing the service does not incorporate area codes within a city but this will be introduced at a later date. International dialing codes and associated country names will also be introduced.

Prestel/Micronet subscribers have a similar facility within the British Telecom database on Prestel. Located at page 383614 is an area code locator. This is used by entering the first three digits of the area code. This will display a list of the areas covered by that exchange. Major cities are covered, so it is possible to get a breakdown of area codes within a major conurbation such as London.

The Price of Microlink

Shortly after the new Tariff changes for Prestel/Micronet were announced, MicroLink issued a statement that it would not be increasing its prices.

However, it appears that even though MicroLink charges have not gone up in the last three and a half years, the operational costs have. In a letter to all subscribers, Derek Meakin, MD for Database Publications which operates MicroLink said that the company could no longer subsidise its customers. As a result, the minimum monthly standing charge of £3 has been increased to £5. This brings the standing charge in line with the rest of Telecom Gold.

In the letter Meakin also promised a number of enhancements to MicroLink, including the addition of yet more gateways both national and international.

Your Commodore notes that MicroLink still represents excellent value for money. Not only does it offer a comprehensive range of facilities beyond what Telecom Gold provides, but MicroLink subscribers do *not* have to pay any block data transfer charges. The data transfer charge was introduced in August 1987 and is a charge for every 512 character-block of data sent/received to/from Telecom Gold.

The Magazine Grows!

Xtra! The magazine suppliment area on Micronet has a new section called Voltage.

The area will cater for those interested in Hi-fi and consumer electronics by providing the readers with news, reviews and features on the latest gadgets for the Hi-tech yuppies among you.

Voltage will be updated on a regular basis and reading it incurs no extra charge for Micronet subscribers. Prestel only subscribers can read Voltage, but are time charged at different rates depending on what time of day the section is read.

The Deamon Dies!

Dataphone Ltd of Peterborough is no more. The company manufactured and sold modems including the Demon II and the Designer.

According to former MD Martin Payne the company was under financial stress for some time. It is understood that extensive delays in obtaining BABT approval for the Demon II and Designer modems contributed to the companies problems.

New backing in the form of a company called Modem Marketing has been sought and the new company will be selling Dataphone products.

Micronet on the Move

Telemap Group Ltd, who's promary product is the Micronet database on Prestel is to move its HQ from London to Apsley near Hemel Hempstead. The move which will be made early 1989 will result in Telemap sharing office space with Dialcom UK. Dialcom is part of British Telecom and incorporates Prestel, Telecom Gold, and a host of other value added services.

According to Micronet the move will result in better communications between The Net and Prestel.

However, *Your Commodore* has received information from several reliable sources who suggest that British Telecom (who currently have a 40% share in Telemap Group Ltd) will buy out the two other Telemap share holders. These are EMAP and Bell Canada.

This would be a logical move on BT's part as it would mean that Micronet (which is the largest IP on Prestel) would be under its control.

Although this information has not been confirmed by the top management at Telemap (who were not available for comment) this writer believes it to be the case.

More Amiga Coverage

Editorial coverage for the Amiga on Micronet has been rather thin until now.

Before, coverage was supplied by the contributors of the 16/32 area. This has all changed as the Solely CBM area provides information for Amiga owners as does the ST/Amiga area which now has a full time member of Micronet's staff writing for it.

At present, there is no seperate microbase on Micronet for Amiga owners, but this may change if the number of Amiga owners subscribing to Micronet increases.

Gateways from Microlink (c) Database Publications

1 : Mnematics
2 : Echo
3 : AIMS Database
4 : Infocheck
5 : Jordan Watch
6 : Official Airways Guide
7 : World Reporter
8 : FinTech – Financial Times Pubs
9 : Petroleum Monitor
10 : Lotus
11 : Kompass
12 : BIS Infomat Newsfile
13 : Wall Street Journal
14 : Grants to UK Industry
15 : Marketing Week

1-15 R(edisplay Q(uit Select :

Gizmos - expandi
Commodor

By Tony Hetherington

For a lot of Commodore users 64K of memory, a joystick and a good selection of games will be enough to occupy all their computing time. But, for others who see their C64 or C128 as a means to explore the world of sound, graphics, teletext and even robotics will find the following pages an invaluable source to all add-ons, gizmos, cartridges and circuit boards that you can use to expand your Commodore.

As with other fields in computing the world of Gizmos is almost totally dominated by a single company. If you think of adventures you think first of Infocom, if you're looking for a printer Epson spring to mind. Similarly in the world of Gizmos, Datel Electronics is the name.

Although Datel still has competition in many areas, its success is a fine example of the potential success waiting for third party companies that are prepared to support machines. Without these companies the C64 and C128 would be good but limited machines and would not enjoy their current success and appeal. Compiling this article has convinced me that whatever the task you wish to embark on with your C64 or C128 there's likely to be a piece of hardware and software available somewhere that will make it a whole lot easier.



Chips and Boards

Chips and circuit boards are an obvious way of expanding your Commodore as they can add to or replace your computer's hardware. You may need some basic knowledge of electronics and be competent at soldering to get the best out of them, however there are some that simply plug into the cartridge port so even the most inexperienced novice can uncover their secrets.

Turbo ROM II/Datel Electronics/ £14.99

This chip replaces the C64s ROM with a turbo version capable of loading and saving programs five or six times faster than normal, and adds a ten second disk format routine and programmed function keys that provides functions such as load and directory and the touch of a key.

4 Way Kernel Board/Datel Electronics/£12.99

This board slots in and replaces the kernal and provides an adaptor that can take 16K or 32K replacement ROMs and a switch so you can swap between the systems.

256K Superom Expander/Datel Electronics/£29.99.

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or Commodore Comn



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l Elec-

Possibly the ultimate in ROM expansion as this expander board has eight slots each capable of carrying a 32K EPROM. The board also is supplied with its own menu driven operating system so you can access any of the eight EPROMS without loading in a program.

An EPROM generator utility will convert your own BASIC or machine code programs and turn them into autostart EPROMs.

In effect the Superom expander provides a neat alternative to hordes of cartridges protruding from your C64 as 2764, 27128 and 27256 EPROMs can be switched in and out as required giving you a suite of instant menu accessed programs.

Eprommer 64/Datel Electronics/ 39.99.

The Eprommer 64 is the ideal companion board for the Superom Expander as it can be used to program 2716, 2764, 27128 and 27256 chips.

Menu driven programs allow you to program, read, verify and copy EPROMs simply so that they're ready for use in the Superom Expander.

The Drive Box/F.S.S.L./£19.95.

The Drive Box once soldered in will allow you to alter the drive number (8, 9, 10, 11) of your 1541, 1571, 1570 or 128D disk drive and also write to the backside of a disk without cutting a notch in the disk as it bypasses the write protect sensor.

1764/F.S.S.L./£99.95.

A plug in memory expansion board for the C64 that will add 256K to your computer in four 64K banks. Supplied with its own power supply the 1764 won't drain your C64 and will give you the extra memory needed in so many development projects.

1750/F.S.S.L./£149.95.

512K is available in this the C128 version of the F.S.S.L. memory upgrade board.

Graphics

The Commodore's graphics facilities are the envy of other 8 bit owners who cannot hope to match the quality and colour of C64 graphics. The following packages help you to make the most of these facilities through a combination of hardware and software.

Blazing Paddles/Datel Electronics/ £24.99.

A combined lightpen and graphics package system that promises to help you get the most out of your Commodore's graphics potential.

The fibre optical lightpen plugs into the joystick port and is ideal for creating computer art as you can simply point to the part of the screen you want to work on. Add to that a software package that includes windows and icons for ease of use and features such as rubber banding, zoom modes, a range of brushes, the ability to cut and paste windows, load and save shapes, windows and screens and a colour mix over 200 hues and the result is a must for computer artists.

Stop Press/AMS/£79.95.

Stop Press is one of the better C64 Desktop Publishing packages mainly due to the inclusion of the excellent AMX mouse.

By moving the mouse and pressing one of its three buttons you can select from the programs pull down menus and create graphics and page styles in which you can paint on text created by a separate word processor. In a recent survey of Commodore Desk Top publishers in the last *Your Commodore* Stop Press scored well. It's success partly due to the easy to use software and partly to the AMX mouse that would top any mouse comparison table. Together they made headline news.

BASIC 8/F.S.S.L./£34.95.

This is an incredible package for the C128 which together with F.S.S.L.'s 64K Video RAM upgrade kit (£19.95) unleashes unimagined graphics power that can even rival the 16 bit machines.

BASIC 8 adds over 50 commands to C128 Basic that allows you to draw a circle, box or 3D solid shape with a single command and includes commands to control windows, create fonts, and select patterns and brushes.

The result of your programming can be displayed in 80 column mode and in mono a resolution of 640 x 200 and 640 x 192 in 16 colour mode.

Sound

Computer sound can be one of its most impressive features but few C64 users are able to make the most of their computer's features. Although there are a number of excellent music packages on the market somebody serious about computer music should check out the sounds of science created by these samplers, midi interfaces and electronic drum systems.

Digital Sound Sampler/Datel Electronics/£49.95.

Sound samplers can be great fun to use as you can record or sample any sound or noise and record it in memory. Once it's there you can speed it up or slow it down, play it back forwards or backwards and add echo, reverb or ring modulation to create an amazing range of results that can be saved for later use.

The Datel Digital Sound Sampler comes complete with a microphone and allows you to store and edit up to eight samples at any one time making it a powerful sound editing

tool whether it is just amusement (making your Granny sound like anything from John Wayne to a Dalek), to mimic the sampled sounds of today's records or to create sound effects for stage and radio.

Com-drum/Datel Electronics/£29.99.

The Com-drum plugs into the cartridge port of your C64 and turns it into a digital drum machine.

Through a menu driven editor you can create drum rhythms in real or step time and store up to eight drum sounds in memory and save them to tape or disk and then play them back through your hi-fi.

A separate Com-drum editor (£4.99) provides the Com-drummer with a disk full of 24 drum sounds that you can combine and edit to provide your own customised drum kit.

MIDI 64/Datel Electronics/£29.99.

MIDI is one of the buzzwords of the 80s and in this case stands for Musical Instrument Digital Interface that can transmit notes and how they are played (duration, pitch etc) to a storage device or an instrument.

For a basic MIDI system you need a keyboard, synthesiser, MIDI interface and computer. Casio is probably your best source of keyboards and synthesisers, your C64 will prove to be an adequate computer and this a suitable interface between the two.

Cartridges

The Commodore family of computers is one of the few that uses cartridges to expand and improve the original system. The cartridge has an obvious advantage over disk or solder in ROM alternatives as they simply plug into the cartridge port and are instantly ready for use.

Unfortunately, the good name of cartridges has been slurred by people who still insist on driving up the price of software by copying programs for friends. The cartridge companies have also fallen into this trap and base their advertising on how quick they can backup the latest releases.

However, now the companies are fighting back by maintaining that their cartridges are programming tools and I would add that every user has the right to backup his software or create a disk version of a tape game as long as it is for his own use. Piracy simply pushes up the cost of programs.

Action Replay IV Professional/Datel Electronics/£34.99.

This is the updated version of possibly the best known cartridge and adds to the features of the original compactor, backup, turbo loading, sprite killing, printer dumping original by adding an onboard custom chip that includes an extended monitor that can freeze any program allowing the serious programmer to disassemble, compare, fill, transfer, hunt, relocate and jump to any part of the code and the restart the program from the place you froze it.

This can provide an educational tool for programmers who want to find out how their mentors created a certain effect.

Final Cartridge III/Datel Electronics/£39.99.

The latest version of the Final cartridge gives your C64 or C128 user a friendly front end as you control everything through windows and pull down menus.

You can turn your joystick into an auto fire stick, kill and disable sprite collisions, freezes games to create screen dumps, includes a sprite and character editor and a programmer's toolkit incorporating commands such as Auto, Renumber, Delete, Trace, Append and Dump. Add to that a calculator, real time clock, notepad and turbo loader and you have a force to be reckoned with.

Expert Cartridge/Trilogic/£29.99

The Expert differs from the other commercial cartridges since it contains RAM and not ROM chips. Although this means you must load in the operating system from disk every time you use it, you can easily and cheaply upgrade the system by changing the disk which costs about £3 and not £30 which would be the cost of a new cartridge.

Smart Cart/Datel Electronics/£29.99.

The Smart Cart is a battery packed 32K RAM cartridge that acts like a ROM cartridge. Although more technical programmers can take advantage of its I/O slots, most users will be more than happy with the way they can load their programs into memory, flick a switch and then for the next five years (until the battery runs out) reload their program in a few seconds.

An 8K version is also available at half the price which makes the 32K version a better buy as well as being more useful.

RAM Disk/Datel Electronics/£9.99.

RAM disk turns your Smart Cart into a 32K RAM disk capable of instantly storing and retrieving files and programs. Through simple commands such as load, save, directory and scratch you can access this storage area as if it was a disk drive with the only difference being that the programs load and save instantly.

3 Slot Motherboard/Datel Electronics/£16.99.

This simple device will save the wear and tear on your cartridge port as it contains slots for up to three cartridges that can be switched in and out as required. So if you've finished using the Final Cartridge you could switch to the Smart Cart Action Replay IV.

64 Doctor/Trilogic/£18.99

Here's a cartridge with a difference as the 64 Doctor is a diagnosis cartridge which examines your C64 and reports back with any problems it finds. In all it performs tests on the keyboard, serial port, cartridge port, kernal ROM, video chip and video banks, NMI and IRO interrupts, cassette data, joystick ports, user port, BASIC ROM, CIA chips, sound chip, cassette key press and even tests out your joystick.

This cartridge was developed by Trilogic as a result of its own work in repairing micros and is designed to produce an accurate diagnosis which will cut down the time and cost of repairs.

Trilogic also produces the Drive Doctor (£14.99) and Datasette Doctor (£8.99) to help you resolve tape and disk loading problems.

Robotics

Robotics is a growing area of interest enjoyed by more enthusiasts every year. Driven on by images of robots in science fiction films they strive to control the outside world from their keyboards. The C64 can be used to experiment in this area with these three Datel packages. They're still light years away from C3PO or R2D2 but it's a step in the right direction.

Robotarm/Datel Electronics/£49.95.

This robotarm has five axis of movement which can be controlled by two joysticks or via the Robotarm interface (Datel £24.99) to your C64 through which you can train or program it to create movement sequences.

Four different attachments can expand its use as you can give your Robotarm fingers, a shovel scoop, jaws or a magnetic attachment.

Robotek 64/Datel Electronics/£39.99.

Robotek 64 is a combined hardware and software package that allows your C64 to talk to the outside world. Four output channels, four input channels, analogue input with full 8 bit conversion and voice input will allow you to experiment with controlling robots and models.

Extras

In any article of this type you quickly run into gizmos that refuse to fall into any predefined categories and they usually end up getting lumped together at the end. This article is no exception so here is a collection of gizmos including a natty little joystick, a teletext adaptor and two add-ons for those Commodore users that are upgrading to the Amiga.

Icontroller/Suncom (Microprose)/£11.95.

The Icontroller is a tiny joystick (little more than an inch high) that sticks on top of the C64 or C128 and plugs into one of the joystick ports but through a second 9 pin adaptor leaves the port free.

This mini stick is ideal for application programs such as GEOS or graphics packages but not for what the instructions describe as "the emotional movement involved in playing certain games".

Commodore 1581 Disk Drive/F.S.S.L./£184.95.

A new disk drive for the C64 and C128 that offers 1 megabyte of memory (800K formatted capacity), 3160 blocks and an impressive 8000 characters per second loading rate.

1571 FIX ROM/F.S.S.L./£24.95.

Developed by Commodore Inc USA this plug in ROM solves most of the many problems faced by 1571 owners whether it be Device not Present errors or problems when using Superbase.

Teletext Adaptor/Microtext/£79.95.

Teletext pages such as those found on BBCs Ceefax and ITV's Oracle service provide a wealth of information ranging from football results to recipes, to weather reports to latest currency and stock prices. Now, with the Microtext Teletext adaptor you can call up the pages on your C64 screen and save the pages to tape or disk.

You can also print them out for future reference and write your own programs that can read the information from the screen buffer and use it in calculation. Applications for these vary considerably from easily inputting a week's football results into a pools predicter to plotting the fall in the pound or predicting the right time to buy shares in a depressed market.

There have been teletext adaptors for computers before but few have been as cheap as this one as it not only connects to your C64 but also to your video recorder and uses its tuner to receive the teletext data. If you haven't a video, and according to Microtext most computers owners have one, you can buy a tuner as well which will increase the combined price to £124.95.

Printlink/Trilogic/£34.95.

Many C64 and C128 owners are now or have already upgraded to an Amiga (the recent price cut will make this move even more attractive) and those who do will be wondering what to do with their old C64 printer. Instead of throwing it away, propping up a wobbly table or giving it away to a friend why not invest in a printlink and use it with your Amiga.

This handy device also adds a 64K print buffer which speeds up the Amiga's notorious sluggish printing speed.

Access 64/Precision/£52.10 (excluding VAT).

This similar device justifies its higher price by allowing upgrading Amiga/C64 owners to also use their 1541 and 1571 disk drives with their new machine and also includes a utility to upload precious sequential files into Amiga format and so ease the strain of upgrading.

Touchline:

***Datel Electronics**, Fenton Industrial Estate, Govan Road, Fenton, Stoke-on-Trent. **Tel:** 0782 744707.*

***Microtext**, 7 Birdlip Close, Horndean, Hants PO8 9PW. **Tel:** 0705 595694.*

***Trilogic**, Unit 1, 253B New Works Road, Low Moor, Bradford BD12 0QP. **Tel:** 0274 691115.*

***F.S.S.L. (Financial Systems Software Ltd)**, 18 High Street, Pershore, Worcs., WR10 1BG. **Tel:** 0386 553153.*

***A.M.S.**, 166-170 Wilderspool, Causeway, Warrington WA4 6QA. **Tel:** 0925 413501.*

***Precision Software**, 6, Park Terrace, Worcester Park, Surrey KT4 7JZ. **Tel:** 01-330 2089.*

***Suncom (Microprose)**, 2 Market Place, Tetbury, Gloucs GL8 8DA. **Tel:** 0666 54326.*

Hi-Res Fill

A better way to fill those awkward spaces

By Colin George Wilson

Over the past few months, I have seen various programs appear in magazines which give alot of help to programmers where graphics are concerned. I have seen programs which plot, unplot and flip points, some which draw lines and circles and others that can even move areas of the screen around. But I haven't seen one capable of filling areas of the screen – intelligently.

There have been spray brush routines, but these take no heed of anything already drawn. What would be useful is a routine which would stop painting when it reaches a point already plotted on the screen.

Certain professional packages such as the designer's pencil already have this facility.

Most of these packages still leave unfilled areas which are in the shadow of some object already present. See figure 1 as an example.

In most fill routines, the computer searches left to right on each line until it meets either the screen edge or a point already present and then draws a line between them. However these routines often fail to recognise corners of odd shapes.

The simple solution would be to re-fill these areas after the main fill has been executed, but another way is to have the computer check for such areas and then, once it has filled the area as it sees it, go back and fill the remainder.

I have written a program to solve this problem. Originally the program was developed using Basic Lightning. (I understand that Laser Basic has a very efficient fill routine built in, but as I bought Basic Lightning before it was replaced by Laser Basic, I stuck with what I had.) The listing is fairly straightforward and could easily be converted to other graphic languages, but as it is in Basic, it runs very slowly.

The second program, a stand alone version of the first, is written in machine code and resides in the 4K above the Basic ROM, and the table below supplies entry positions for both Basic and machine code programmers. The source listing has been included for those of you who wish to modify the program for your own uses.

Next, let me explain how the fill routine works. Most people (judging by the amount of hi-res graphic aid listings there are) roughly know the principles of plotting points so I will deal specifically with the fill routine.

First, a buffer area is reserved for the computer to store the co-ordinates of any areas it will need to return to. In Basic, this is matrix ED (number of areas, 1). In machine code, it is a 1K buffer capable of storing 255 sets of co-ordinates.

The key lines in the Basic Lightning listing are explained here.

10010 A buffer pointer is set to zero. This counts the number of co-ordinates found and acts as an index into the buffer.

10015 Two flags, H1 and H2 are set to TRUE (-1). The purpose of these

Figure 1.

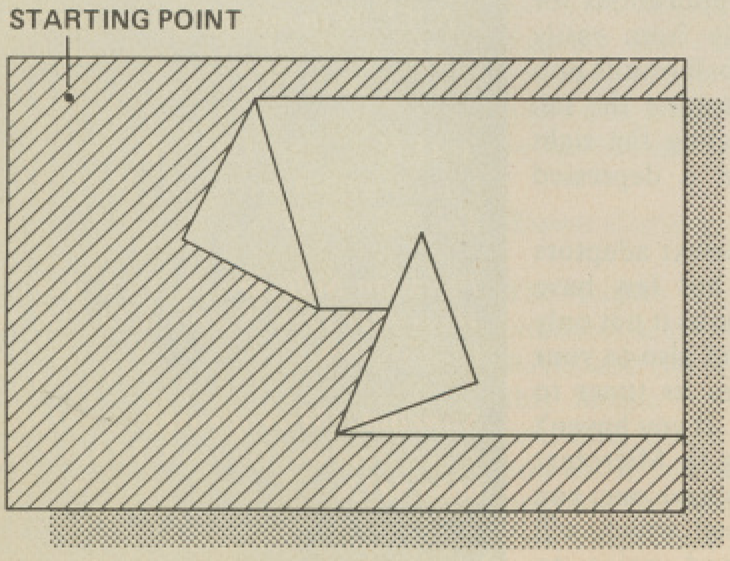
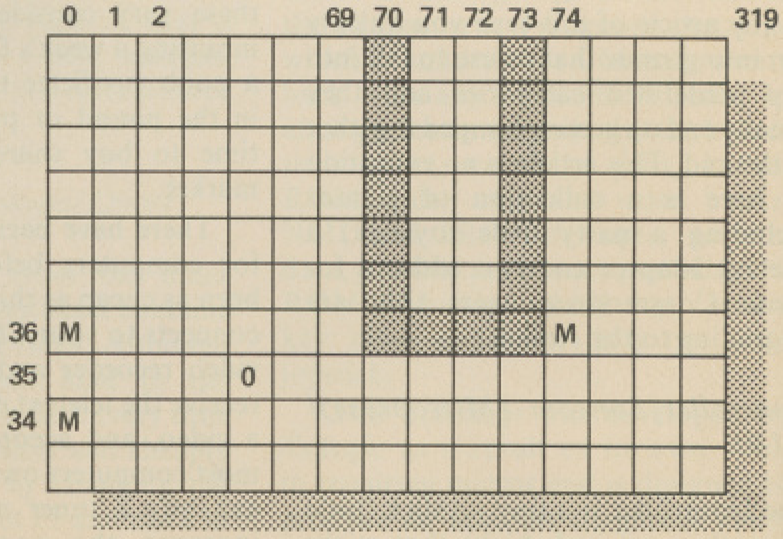


Figure 2.



flags is explained in detail later on.

10050 The computer now searches to the left of the start co-ordinates until it finds the screen edge or a previously set point.

10090 It now performs an identical search to the right of its new found co-ordinates for similar conditions. This time, for every point found blank, it is filled. A subroutine is also called to check for blank areas both above and below the plotted point.

10130 If the buffer pointer indicates that there are no further areas to be filled, the routine finishes.

10140 If not, the last set of co-ordinates stored are retrieved, and the buffer pointer is reduced accordingly.

10150 This continues until either the buffer pointer registers an empty buffer, or the co-ordinates retrieved indicate that the area is still blank.

10160 If the area has been found blank then the fill routine is re-initiated with the new co-ordinates in mind.

10170 Now that everything has been filled, the routine is TERMINATED.

The heart of the program lies in the search routine. This is called every time that a point is plotted on the screen by the fill routine. It works in the following way:

Two flags, H1 and H2 have two states; TRUE (-1) or FALSE (0), and are used to note exactly what is being searched for above (H1) or below (H2) the plotted point.

If the flag is TRUE, then the computer is looking for an empty point. When it finds one, its co-ordinates are placed in the buffer, and the buffer pointer is incremented. The state of the flag is now flipped, and it becomes FALSE. This state now informs the routine that an area has been found, and that a possible dividing line between another such area is being sought i.e. a 'set' point. This prevents the routine from memorising 319 dots where one or two would be sufficient. It is probably BETTER understood with the aid of figure 2.

The points set in column 70 and 73 and row 36 indicate where the bottom line of a rectangle lies. The circle indicates the start position of the fill routine, and the 'm' signals the points that will be memorised by the computer.

First, a search is made to the left for either a point or the edge of the screen. The latter is found first, so the computer starts drawing a line from 0,35. Both flags H1 and H2 have been set to TRUE to look for and 'unset' points.

They both find one immediately, so the co-ordinates 0,36 and 0,34 are noted. H1 and H2 now become FALSE as an area has been found.

Because these flags are now. FALSE, the computer continues its search, this time for a 'set' point.

The first to find one is H1 at 70,36. This simply causes the computer to turn H1 back to TRUE to look for a nutter blank point. The co-ordinates 70,36 are then forgotten as they are of no further use.

The plotting and searching continues until 74,35 is reached. Because H1 is now TRUE, The computer notes co-ordinates 74,36 and turns H1 back to false again.

This time, the computer finishes the line without finding any further 'set' points above or below the line. Now it returns to check its buffer, and three co-ordinates are found:

0,34 – below the start of the plotted line
0,36 – above the start of the plotted line
74,36 – to the right of the rectangle

The last set of co-ordinates are taken and tested to see if the area has been filled from another direction. They are found to be blank, and so the computer recalls the fill routine with these co-ordinates and this line is scanned in an identical way:

10190 If we are hunting for an 'unset' point.

10200 Check the point, if it is 'unset', move the buffer pointer on by 1, memorise the co-ordinates and flip the flag.

10210 Otherwise.

10220 Check if the point is set so that we can flip the flag the other way.

10240 – 10280 Repeat the above procedure with the H2 flag, scanning below the plotted point.

NOTE: Basic Lightning uses the TOP LEFT as its origin (0,0) but the machine code version uses the BOTTOM LEFT.

The memory for the machine code version is allocated as follows:

$C000 – $C358 M/C routines
$C359 – $C7FF Free
$C800 – $CBFF Buffer area
$CC00 – $CFFF Hi-res colour screen
$E000 – $FFFF Hi-res bit mapped screen

The routines HIRES and LORES move the screen and switch video banks so that Basic loses no memory at all. Locations $C359-$C7FF are available for other machine code routines. The ones I have supplied are as follows:

HIRES	SYS 49152	Switch hires screen on
LORES	SYS 49184	Switch hires screen off
CLG	SYS 49216	Clear the hires screen
PLOT	SYS 49470,X,Y	Plot point X,Y
UNPLOT	SYS 49480,X,Y	unplot point X,Y
INVERT	SYS 49490,X,Y	eor point X,Y
FILL	SYS 49865,X,Y	fill hires screen from X,Y
COLOUR	SYS 49991,A	set hires colour to a (0-255)
POINT	SYS 50002,X,Y	read point X,Y - peek (780) returns 0 if no point set, 0 if there is.

Getting it all in

The Basic program 'Lightning Fill' is provided for those of you with Oasis Software's Basic Lightning program.

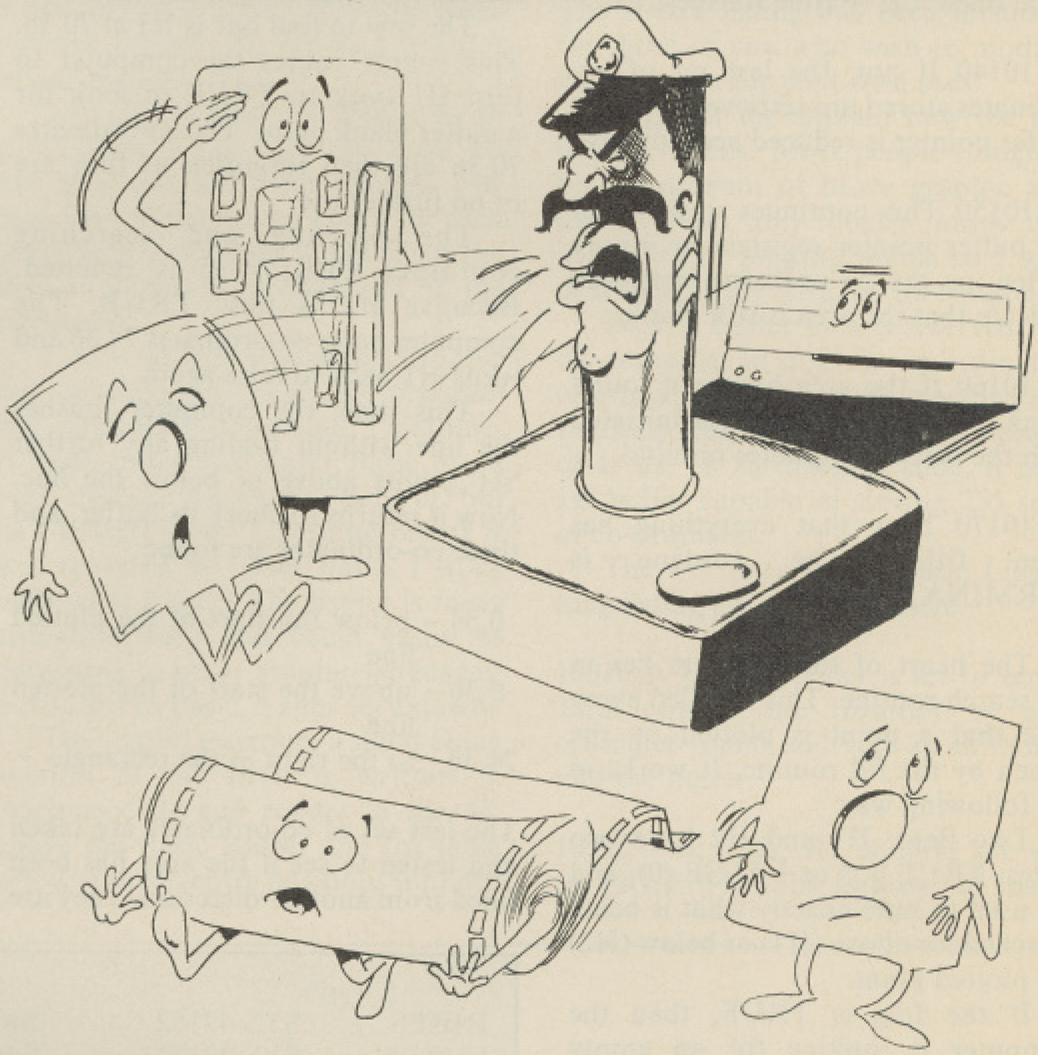
'Hi-res Fill' is the basic loader for the stand-alone machine code version.

See listings on page 61

Joystick Cursor

A chance to control the cursor and other keys with the joystick with some handy results

By James Kew



This utility program allows the joystick to be used to control the cursor. It can also be modified so that the joystick emulates any other keys, which can be very useful for adding joystick control to BASIC programs. The four files associated with this program are:

JOYCURS	A BASIC loader
JOYCURS.OBJ	The machine code object file loaded by the above
JOYCURS.SRC	A source code file (loads as a BASIC program) for ASSEMBLER/MONITOR 64
JOYMOD	A BASIC program which modifies the routine

The routine is interrupt controlled. It is loaded into the tape buffer where it occupies 128 bytes, $033C-$03BB (828-955). To load the utility, load and run JOYCURS. The cursor can now be moved around the screen using a joystick in port 2. Pressing FIRE and a direction emulates the following keys: FIRE/UP = Return, FIRE/DOWN = Space, FIRE/LEFT = Delete, FIRE/Right = Insert

The auto-repeat can be turned on and off by poking location 922. Poking with 0 turns repeat off, with 1 turns it on.

The default settings are very useful for editing programs, but can be changed by loading and running JOYMOD. The program here will load the machine code file and will run through the joystick directions, with and without fire, asking for each one which key that particular action is to modify. If no key is to be emulated, press ←. The program also modifies the default value of the repeat flag. It is then possible to save the modified routine from inside the program so that it can be booted from the users own programs.

(For the technically minded, the program modifies a reference table starting at 923 which contains all 32 possible combinations of the five joystick bits in sequence – many of which are impossible to achieve with a joystick. The table contains the CBM-ASCII values of the keys to be emulated, with 0 representing no key.)

See listings on page 61

Games Update

Alot of budget releases available this month – handy if you're short of the old pennies this month

Yet another quiet month with only a few full price releases as the software companies hold back their major titles for the main autumn offensive. There is however, a plethora of budget games available for anybody looking for the odd pocket money game although it must be said, that a lot of these titles are previously released full price games.

Full Price Titles

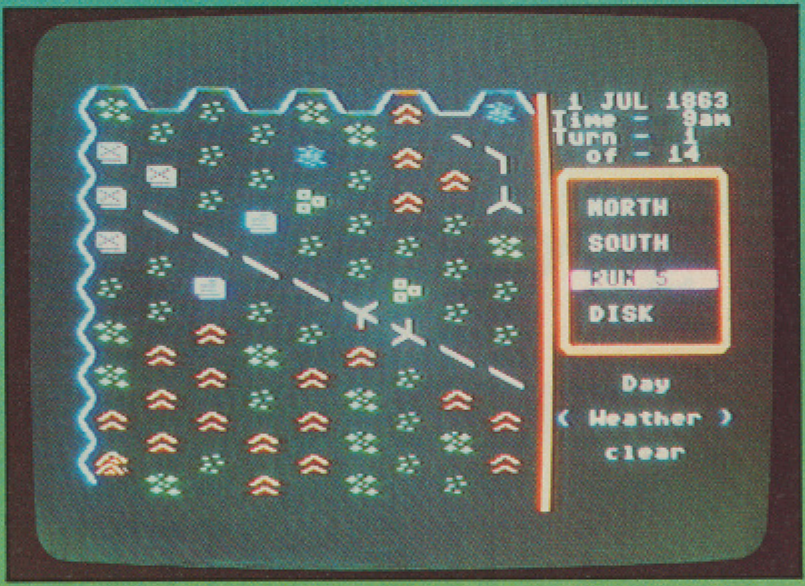
Anybody looking for a bargain could do a lot worse than investigate *Chart Busters* from Beau-Jolly. It seems that even compilations are getting bigger and better as this one offers no less than twenty titles. Most of the games were originally released at a budget price and those that weren't are now showing their age somewhat but nevertheless, there are some nuggets of gold among the also rans.

The titles include *Dan Dare, Tau Ceti, Rasputin, Park Patrol, Thrust, Eyeball, Way of the Exploding Fist, Ghostbusters, Olli* and *Lissa and Brian Jacks Superstar Challenge.* My personal favourite though is Zolyx, a fast thinking strategy game that shows that great graphics aren't necessary for a game to be addictive. On a score of 1 to 100 for presentation, Zolyx comes in at minus five!

If you are looking for something a bit more challenging on the strategy front, then there is the latest release from the Australian wargame company SSG, marketed by Electronic Arts. *Decisive Battles of the American Civil War Volume II* (disk only) lets you recreate five battles including the decisive Gettysburg and Chickamauga. These two, if handled differently could have turned the whole outcome of the War so here is your chance to prove that you are a better general than Robert E. Lee. As is usual with SSG games, the presentation is superb and a complete construction set allows you to design whatever variants you choose.

Apart from *Netherworld* (see elsewhere in this issue) Hewson has also released *Marauder.* As with all their releases, presentation is first class but the game itself, a vertically scrolling shoot 'em-up has been seen a thousand times before and offers little that is new.

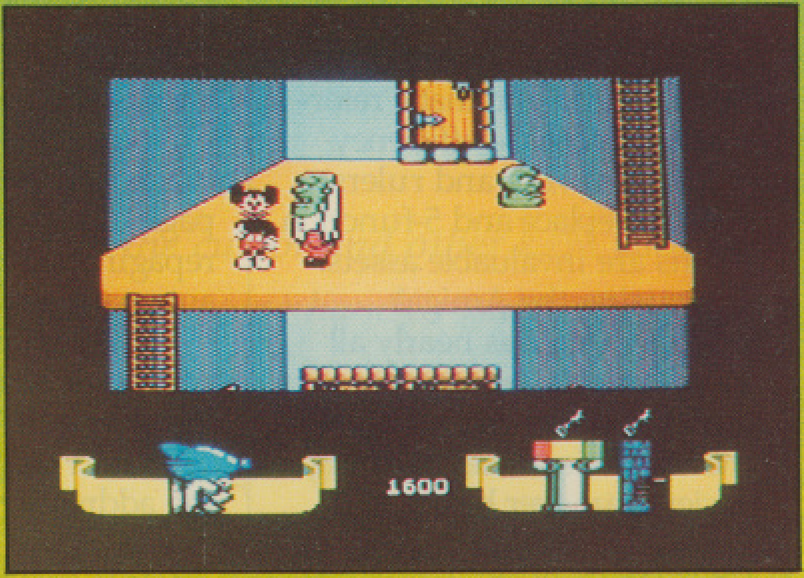
From Gremlin comes *Mickey Mouse* in a game that I didn't really enjoy but which might appeal more to younger players. Mickey has to climb four towers with the ultimate aim of defeating the ogre king. *En route* he must nail shut all the side doors which involves playing four sub-games. There are ghosts and skeletons to be battled using either



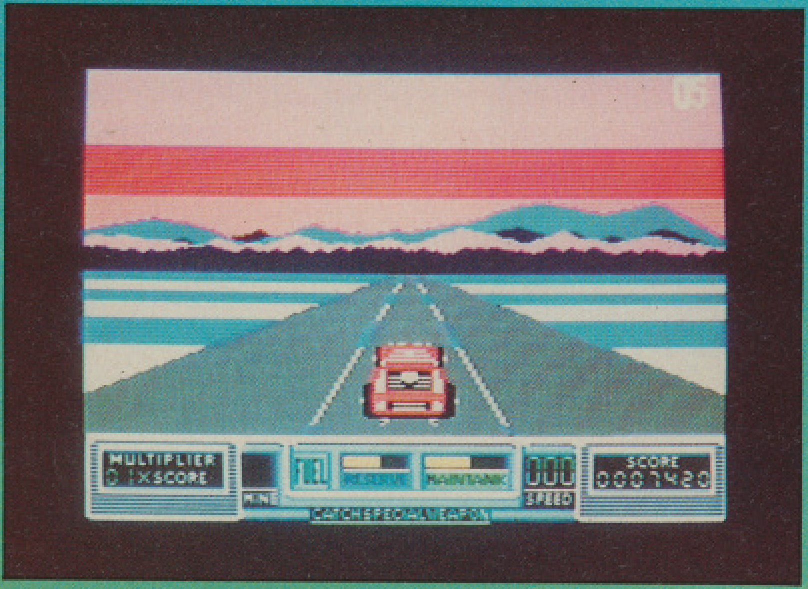
Decisive Battles of the American Civil War



Marauder



Mickey Mouse



Road Blasters

the magic water pistol or rubber mallet but I reckon that anyone playing the game will get more nightmares from listening to an appalling rendition of Paul Dukas' Sorcerer's Apprentice – the bit of the film Fantasia starring Mickey.

Also from Gremlin comes *Blood Brothers,* an arcade adventure for one or two players involving a chase through some mines in search of the Scorpions, a group of space convicts. Although it looks attractive, the gameplay itself left me cold and I just did not enjoy this one at all.

A racing game where you have to blast everything in sight sounds like a good idea but *Road Blasters* from US Gold is yet another game that doesn't quite work. You have to get from A to B within the time limit while at the same time wiping out anything that gets in your way – cars, bikes, mines and gun turrets to name but a few. You can get extra weapons delivered to you from an overhead spaceship if your shooting skills warrant them. Graphics are poor and the scrolling is non too hot either, making control of your car somewhat difficult.

Budget Games

Firebird are the major contributers to this month's budget choice. European five-a-side is actually one of the more playable football games around. In other words, it is possible to take the ball from an opposing player. Nor are you faced with a superhuman computer controlled goalie who manages to stop everything that you kick at him.

There are problems though. Your men have a habit of all rushing up field and staying there so when the time comes to defend, there is no-one there to do it. There is also the habitual problem of control being given to the player that you don't want. The most serious fault though is that it is possible to reach a stalemate position. I became trapped between a defender and the goalie with the ball bouncing out to the corner flag and the goalie diving to save the rebound. The choices were to wait for eight minutes until the game finished, or pull the plug...

Beach Buggy Simulator sees you competing in the dune trials and what trials they are. Apart from having to jump over rocks and other hazards, there is also the slightly more serious problem of passing helicopters trying to blow you to bits. The organisers do however do you the courtesy of fitting your buggy with a gun offering some small crumb of comfort. All this is against a strict time limit with the added problem of dimishing fuel supplies.

I thought that every possible variation of title containing the word *'Ninja'* had been used up, but no, for there on the desk in front of me is *Ninja Scooter Simulator.* Apart from appearing in the title, the word *'Ninja'* has no connection with the game whatsoever but there again, I don't suppose that an ordinary scooter simulator has vast amounts of appeal. In practice, the game is a variant of a well worn theme. Race along a track within a time limit, leaping over ramps, avoiding obstacles and doing mid air tricks if you feel so inclined.

Racing seems to be this month's main theme. *American Road Race* is an old (1985) Activision game. Choose your opponents and course and head off as quickly as you can avoiding anything that gets in your way. Frequent gear changes are required and you will need to watch your fuel gauge if you are to cross the line first. There are no cars coming towards you to worry about, the only real hazard being when the screen turns black at night time!

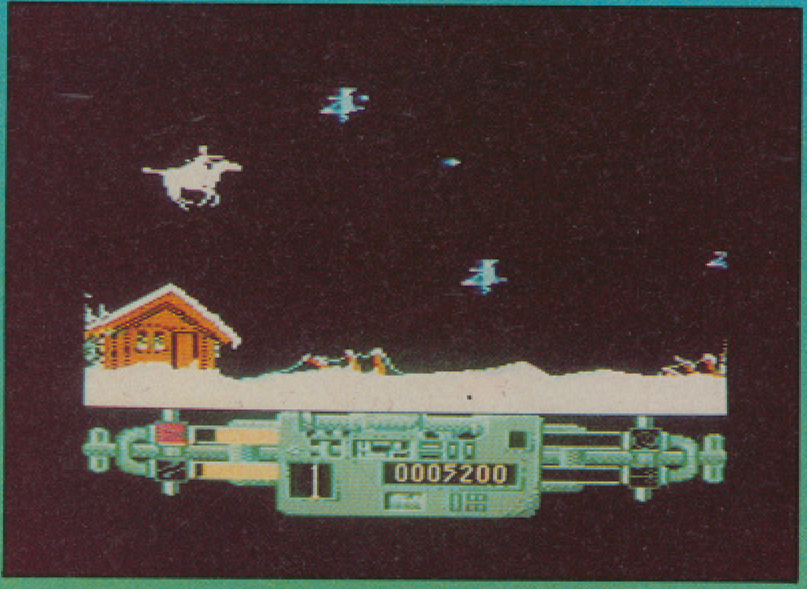


Stunt Bike Simulator

My opinion of stuntmen is that they must have an IQ almost as low as Leeds United supporters or magazine editors. Anyone who wants to do that for a living has got to be crazy. Nevertheless, is seems that there are plenty of crazy people about, and at the moment there is no law against stupidity. *Stunt Bike Simulator* (that seems to be Firebird's favourite word this month) lets you dodge obstacles as you attempt to catch men leaping off hang gliders, jump through rings of fire and try to catch hold of passing helicopters.

The theme of shoot 'em-ups whereby as you improve, so you collect bigger and better weapons has been done to death over the past year. So what have Firebird done to add a spark of originality in *Trojan Warrior?* They have got rid of the ubiquitous spaceship and in its place, substituted a man on a winged horse! And what is the object of your quest? Yes, its yet another princess that has managed to get herself captured! Don't call us, we'll call you.

The final release on the Silverbird label is *Slimeys's Mine* retailing at £2.99 (all the others are £1.99). Hopping from asteroid to asteroid, you must find the entrances to the mines which in turn need to be explored in order to find and assemble bits of a spaceship. Once inside the mine, a screen can only be left when you have shot sufficient aliens to find a red diamond. There are assorted bubbles and boulders to be avoided and maps and banana bombs to be acquired. A decided novelty this month, an original idea!

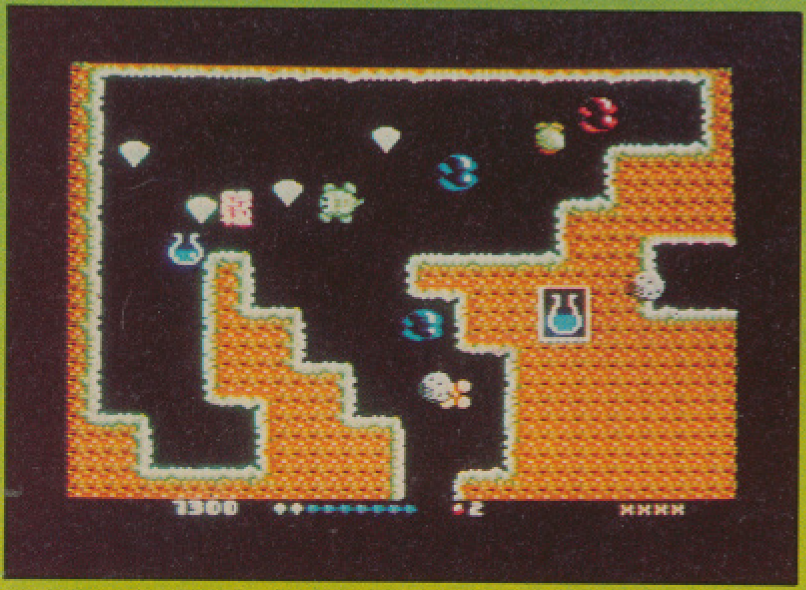


Trojan Warrior

From Codemasters comes *Poltergeist,* a thirty-two level shoot 'em-up on the lines of *Trojan Warrior* above but without the originality. It is however a lot faster, more complex and better designed than its rival and represents much better value for money.

One of the most interesting budget games is *Rogue* from Mastertronic. It is a sort of one player role playing game-dungeons to be explored, treasure to be found and monsters to be bashed. The map of your surroundings is quickly drawn, all you do is use the pointer to indicate where you want to go. The pointer is also used to manipulate any objects that you find so that you can wear armour, weild (sic) a weapon, eat food etc. You have a number of hit points determining how much damage you can sustain, but you must also watch your ever decreasing strength which needs food or magic to replenish it.

The game doesn't quite work in so much as it is too easy to get killed early on. One of the problems is that combat depletes your strength rapidly as well as your hits and the game tends to be over before you know it. Should you manage to survive the early stages – the use of magic items is necessary, you can save your current character to live and fight another day.



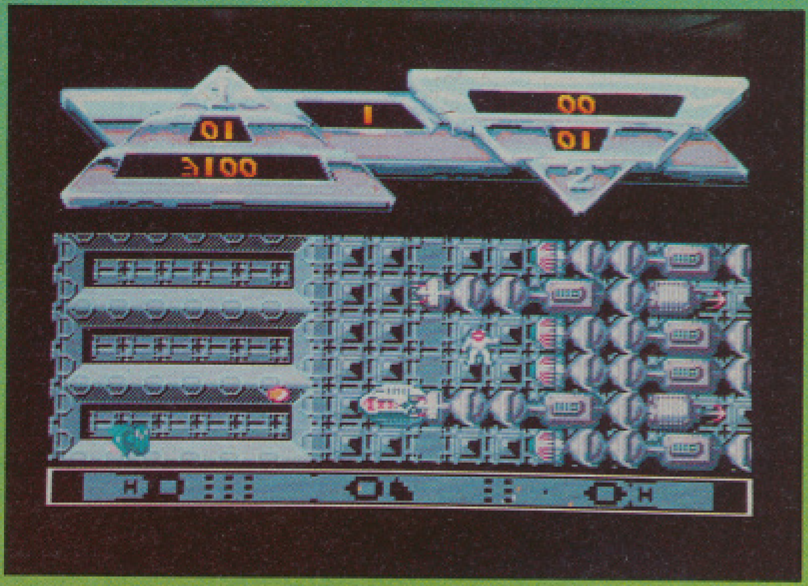
Slimey's Mine

Amiga Games

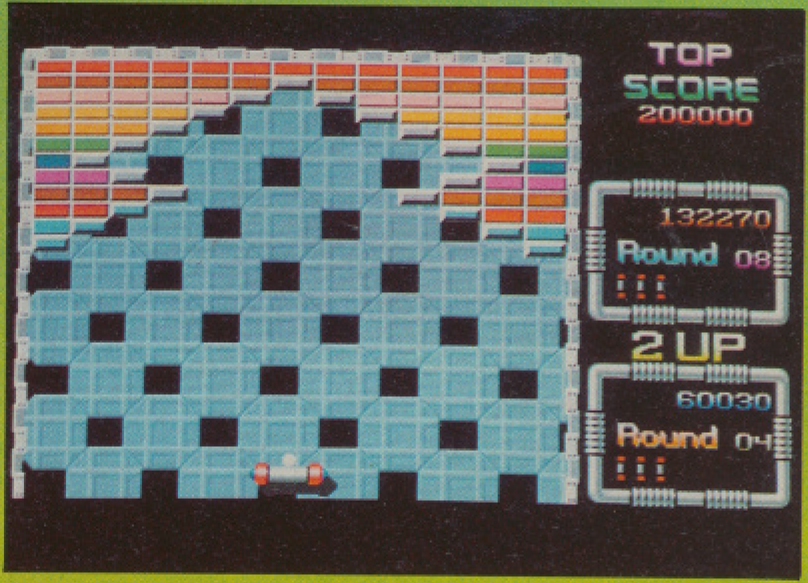
Things are also quiet on the Amiga front this month with no games that really make you sit up and take notice. Pick of the crop is undoubtedly *Bards Tale II* from Electronic Arts, an excellent although difficult role playing game. There are spells and monsters galore as you battle your way through dungeons and wilderness searching for the seven parts of the destiny wand.

Peter Beardsley's International Soccer is released at an unfortunate time, coming shortly after England's dire performance in the European Championships. The game is almost as lack-lustre. The animation of the players is jerky, the computer opponent too difficult and all too frequently, the wrong player put under your control. The added features of throw ins and corners add little to the game. Best stick to playing against a friend.

Still on the sporting theme, *World Tour Golf* from Electronic Arts. Not quite as playable as *Leaderboard,* it nevertheless offers a real challenge. Don't do as I did and choose the Nasty Nine for your first course when you don't really know what you are doing. Eighty-two over par for nine holes is not a score to brag about!



Return to Genesis



Giganoid

Return to Genesis from Firebird is a shoot 'em-up involving the rescue of a load of scientists. Guess what? Some of the scientists can give your ship extra weapon systems. Now where have I heard that before?

Finally this month comes *Giganoid* from Swiss Computer Arts, an almost exact copy of Arkanoid. Sure, the shapes of the screens have been changed but the falling capsules are identical, even down to the letters on them. Why does 'P' represent a bonus life? Take my advice and stick to the original. YC

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The CP/M Kit introduces and explains the unknown, third mode of the C128. The CP/M Users Guide is a 300 page book by Abacus Software covering all aspects of CP/M. Subjects which include the system disk, resident commands and disk copying are described in detail. The CP/M kit contains over 20 CP/M programs including a word processor, chess game and a disk cataloguing program accompanied by a detailed guide to running programs in CP/M. The CP/M kit and Users Guide. **Only £34.95.**

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New from SOGWAP Software Inc., The Big Blue Reader is ideal for those who use IBM PC compatible computers at work and have the Commodore 128 or 64 at home. The Big Blue Reader is not an MS-DOS emulator, but rather a unique and easy way to transfer word processing, text and ASCII files between two totally different formats, Commodore and MS-DOS. The Big Blue Reader requires a 1571 on both the Commodore 128 and 64 and will not work with a 1541 or similar drive. **Only £34.95.**

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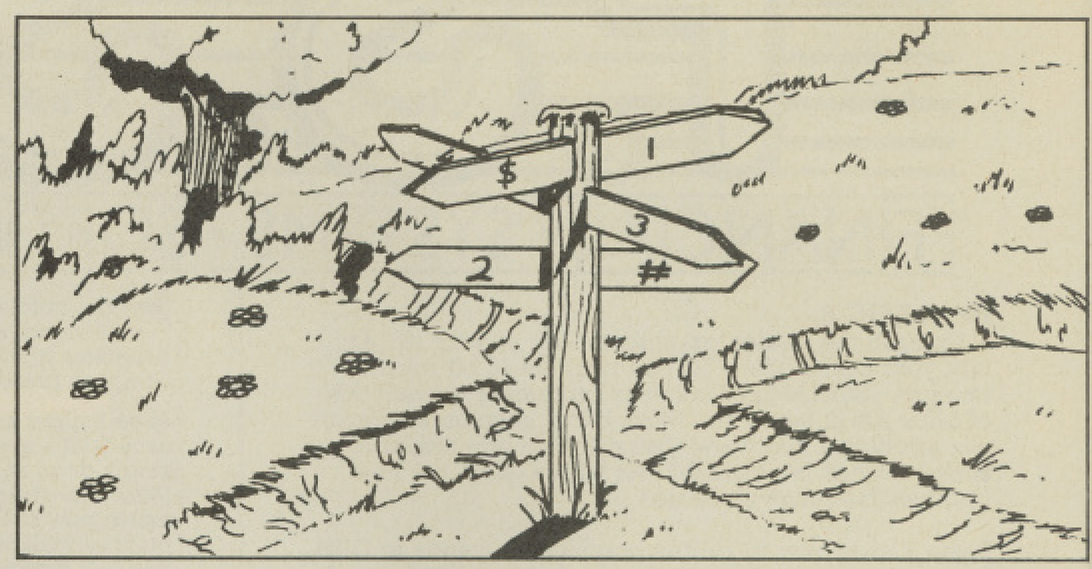
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Code Relocation



Post process a program and turn it into code that, with a bit of run time processing, can be relocated in any part of memory

By Dave Garside

The area of RAM between $C000 and $D000 has always been a popular area for machine code programmers. The lack of interference from BASIC and the operating system makes this area ideal for small utility programs. Consequently almost all utility programs published are written to run in this area.

Now while this is no problem when each utility is used in isolation, it would often be nice to combine some utilities into a tool set. The problem then becomes one of space and memory conflict. Because the chances are that the particular routines you would like to combine occupy the same area of store.

Of course there would be no problem at all if the offending code could be relocated to a different part of memory: after all there is plenty of space available. However 6502 code is hardly ever relocatable. The reason being that because of the nature of the instruction set, it is extremely difficult to write relocatable code for anything but the simplest of programs. However it is possible to post process a program and turn it into a code that, with a bit of run time processing, can be relocated to run in any part of memory. The utility presented here provides the tools to perform that processing.

How It Works

The easiest way to explain how the relocator works is through a simple example. Consider the following piece of source code:

```
        ldx # 0
bl      lda store,x
        beq fl
        jsr charout
        inx
        bne bl
fl      rts
```

```
store txt "this is a very trivial example"
        byt 0
charout=$ffd2
```

Assembled to memory locations $c000 and $4c00 the above routine would appear as follows in a disassembly:

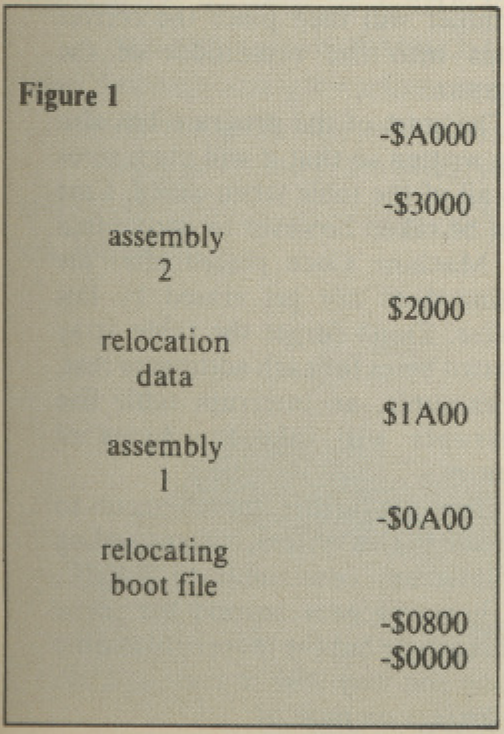
```
c000 a2   00    ldx  # 0
c002 bd   0e c0 lda  $c00e,x
c005 f0   06    beq  $c00d
c007 20   d2 ff jsr  $ffd2
c00a e8         inx
c00b d0   f5    bne  $c002
c00d 60         rts
c00e 54         byt  $54
c00f 48         etc for rest of string
4c00 a2   00    ldx  # 0
4c02 bd   0e 4c lda  $4c0e,x
4c05 f0   06    beq  $4c0d
4c07 20   d2 ff jsr  $ffd2
4c0a e8         inx
4cob d0   f5    bne  $4c02
4c0d 60         rts
4c0e 54         byt  $54
4c0f 48         etc
```

If we consider the binary representation of the two pieces of code it can be seen that the only bytes that are different are those containing the high byte of the start address for the text string 'store'; the relative branches will have the same offset values, the address for charout is the same in both cases and the low byte of the start address for store is the same because both routines are assembled to start at a page boundary.

This establishes the first principle on which the relocator is built – when a program is assembled to two different parts of store, each starting at a page boundary, the only bytes that will differ are the high bytes of addresses that vary with the program start address. And these bytes can be identified by comparing two such assemblies.

The relocator does just that, but on finding a difference it replaces the byte with a marker value and stores the offset value (actual value-start address) in a table appended to the end of the program. Before it can do the comparison the relocator has to decide the marker value, which must be a value that does not appear in the program being processed. It does so by doing an iteritive search on the first assembly until it finds an unused byte. This might seem to constrain the use of the utility, but in practice programs that use all 256 possible values are rare unless they contain lots of graphics.

Once the program has been processed the utility appends a file containing the user end of the relocator to the beginning of the market program, and then saves out the whole package as one complete file. The overall memory requirement for producing a relocatable version of a 4K utility is shown in Figure 1.



From Figure 1 the following constraints can be deduced:

(1) The lowest point in memory for the first (processed) assembly is $0800 plus the length of the boot file which is fixed at $0200 bytes.
(2) The second assembly must start above the first, although it is not necessary to allow space for the relocation data as the second assembly is only processed once and it does not matter if it is overwritten by the data table.
(3) The end of assembly 2 must fall below $A000.

This gives a limit to the size of a relocatable program of $9400/2 bytes i.e. approx 18K, which is more than enough for most utility programs.

The relocating boot file simply does the reverse of the relocating processing: it prompts for the new start address and scans the program from start to finish for the marker bytes. If it finds a marker, it looks up the relevant offset in the relocation data, adds the high byte of the new address and pokes the result back into the program.

When all the markers have been processed the program is booted to the start address and the user is prompted as to whether the program is to be executed. If the answer to the prompt is positive, control is passed to the first instruction of the program. Note that this is the final constraint on using this utility; the first instruction of the program must either be the run address or a jump to the real run address. If the user does not want to run the program immediately, control is returned to the interpreter and the start address is displayed in decimal.

Using the Utility

There are really two sets of user instructions, one set for the programmers producing relocatable programs with this tool, the other set for the end users.

The user – using a relocatable program is simplicity itself. The program formed by the relocator is a machine code program with a BASIC front end, so the program is loaded and run as you would a BASIC program. From then on all the required information is given on the screen.

The user is supplied with the length of the program and asked to provide the new start address, which is done by over-typing the default address of $C000 and pressing return (note that the start address given must be such that the boot program is not overwritten, i.e. the area $0800-$0A00 must not be used). The program is relocated to that address and the user is then asked to indicate whether the program is to be started straight away. A negative response results in the start address being supplied as a decimal figure, an affirmative reply activates the program.

The Programmer – to produce a relocatable version of a program follow these steps:

•Load and relocate the utility as described above, but do not run the program.
•Assemble two versions of the program to be processed according to the constaints identified above.
•Now run the relocator by SYSing the start address.
•From this point follow the instuctions given by the program.

NB There is only limited error checking provided by the program, so ensure that disk drives, etc are connected and switched on, and there is sufficient room on the disk/tape to receive the finished program.

Finally by way of an example of the increased flexibility given by relocatable programs, I've included (listing 2) a version of the public domain program 'Supermon 64'. This version will relocate to anywhere in normal RAM so is really useful when developing machine code programs because you can squeeze it into any available 2K slot.

Both the Relocator and Supermon are supplied as BASIC loaders and the following procedure should be observed:

•Type in the listing.
•Save before running.
•Run the program which will convert the BASIC data back to machine code.
•At the prompt, give a filename, and at the following prompt specify tape of disk.
•The program will be automatically saved and can then be tested.

See listings on page 61

A Short Interlude

We follow on from last month's explanation of how to use interrupts to carry out several tasks at once

By Michael Tinker

The routine presented this month is much more sophisticated and a lot easier to use particularly with utility interrupt programs.

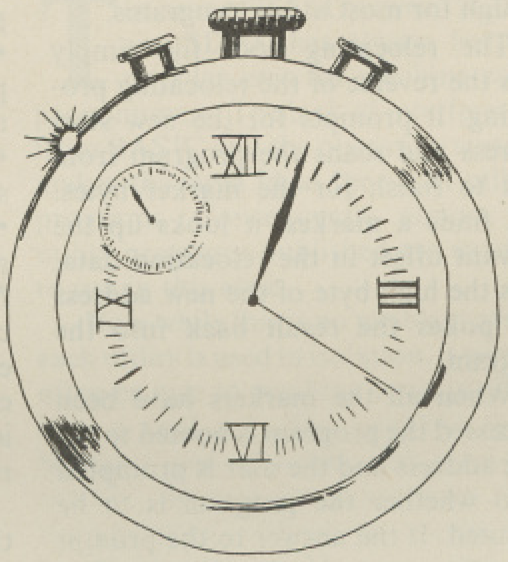
To refresh your memories (no pun intended), last month's program executed up to five interrupt routines stored in a short table. This enabled varying numbers of routines to be used at once.

The main shortcoming with the last program was that it was virtually essential to use a Machine Code monitor to add or remove routines from the table of interrupt routines. Therefore this month I have added a "wedge" into the CHARGET routine to enable the extra facilities to be added.

These facilities are a list command which will list all the interrupt addresses being called, an add command to enable addresses to be added to the table and a remove command to enable easy removal of interrupt routine addresses in the table.

How does it work? First allow me to give a quick explanation of what a wedge is. A wedge is a small routine placed into the operating system of the computer so that when a pre-determined action takes place the wedge will pass control to your own routine.

In this routine I have placed the wedge into the CHARGET routine which is used to get a character from the input buffer when in direct mode or from a BASIC program when one is running. The wedge routine first checks that the computer is in direct mode then looks to see if the first character is the left arrow symbol. If it is, further checks are made to find out what the command is.



For the commands I have chosen "A" for add, "R" for remove and "$" for table directory. The full commands are as follows:

- left arrowAinterrupt #, address (in decimal)
- left arrowR interrupt #
- left arrow

For example: left arrowA2,12288 will add the routine address 12288 into interrupt number two position in the interrupt table and the routine will then be called on every interrupt along with any further routines in the table.

Notice that the system also stops the interrupts while it inserts the address into the table and restarts them afterwards. This will prevent a complete "lock up" while the address is only partly changed.

One of the features of this improved system is that when using the Mikro Assembler program listing the size of the table can be easily changed. At the top of the listing is the constant called Maxint; this gives the maximum size of the interrupt table.

To change the size all that you need to do is to change this one number before assembling the program. The assembler will then place the correct values into the remainder of the program.

The start of the program has also been written so that it will place zeros into all of the table when called. Care must be taken however to ensure that any Machine Code placed after the routine does not get erased by this process. Don't forget the table array uses two bytes for each address so that, for example, an interrupt table five interrupts will take ten bytes of memory.

There are further improvements to be made to this system, such as adding the interrupt commands to BASIC, this however goes beyond the scope of this article but the more enthusiastic among you may wish to try.

See listings on page 61

The day Roger Jackson sent his first mailshot.



I was impressed by the fact that Star have now produced a great looking little budget printer with a 24 pin head.

I was impressed by its excellent quality – the 8 resident fonts available and its high density letter quality helped me produce a really professional mailshot.

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I was impressed by the special push-tractor feature that allows the LC24-10 the lowest possible tear off and its ability to 'park' continuous paper and load single sheets automatically – so there's no need to remove the continuous.

I was impressed by the touch-button front control panel that makes using the printer an absolute dream.

But most of all, I was particulary impressed with myself.

Because my Star LC24-10 was so inexpensive and no other printer comes close for sheer quality and value-for-money.



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Please tell me how the Star LC24-10 can handle my printing needs.

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Or just call Belinda on 01-840 1829. 24 YC 10

May I Interrupt

Fine tuning is the key to setting up a continuous music routine

By Eric Doyle

No game is complete without sound effects and music. The art of programming sound involves the impressive array of registers which forms the SID chip and, though I did not intend to go into depth on this subject, a little understanding of the nature of the chip is essential.

Sound effects are 'spot effects' which means that something occurring on the screen is accompanied by a synchronised sound. This is often better handled outside the interrupt system and music is the usual area of interest for interrupt handling.

A sound has several elements; pitch, loudness and shape. In reality, this is a complex relationship but on the SID chip complexity has to be created. The majority of programmers can never hope to reach the symphonic complexity of Rob Hubbard's work, but impressive sound can be produced with a modicum of knowledge and skillful editing.

Each of the three voices of the SID can span seven octaves and the range is more akin to a violin than a piano. This is because a piano has fixed notes which cannot easily be altered (tuned). Play each successive note on a keyboard and the best result is still a series of steps. A violin can produce the same accepted range of notes which form the western concept of music but, by sliding a finger up and down the strings, a continuous rising or falling sound can be produced which includes frequencies that are not catered for in the accepted concept of scales of equal temperament.

The SID is stepped but only in small increments which can fool the ear into believing that a continuous, rising note is being produced. For sound effects this is wonderful, but for music a certain degree of editing is necessary.

In machine code programming, a look-up table based on Table 1 is faster than calculating the value of each note's frequency. All frequencies in the range have values greater than 255, or one byte. For this reason each voice has two locations for the pitch frequency – a low byte and high byte store.

Beyond pure pitch a sound has a shape. Sharply press a key on the piano and a sudden noise is produced. It rises to full volume instantly and then dies away gradually, bang a table and the sound appears and disappears almost instantaneously, or draw a bow across a violin string and the note will gradually build up and fade. There are four elements which describe a sound shape to the SID: attack, decay sustain and release. Together these elements are known as the sound or ADSR envelope.

Attack is the time taken for the sound to reach full volume. Decay, sustain and release are related and describe the way in which the sound dies away. Decay describes how quickly the sounded note falls away immediately after maximum volume is reached, sustain determines the time at which the release phase takes over from the decay and release is how quickly the note disappears. Effectively, decay and release are two parts of the same downward slope separated by the sustain plateau.

For the piano, a short attack phase would be followed by a slow decay and a fast release, the banged table would have a fast attack followed by a fast decay and release, and the violin would have a slower attack followed by a slow decay and moderately slow release. Most diagrams of the ADSR show sustain as a plateau but this is not always the case. Sustain determines how long the decay lasts before release takes over (Diag 1).

Another aspect of sound shape is the waveform. This can be sawtooth, triangle or pulse, each name describing the oscilloscope trace which the wave produces. Sawtooth and triangle are also very descriptive of the sounds that they produce – sawtooth is a rasping sound and triangle gives a gentler, ringing tone.

Pulse is more variable than the other two and is as near to a pure sine wave that the digital nature of the computer can produce. When using pulse a width has to be specified for the wave which determines the harmonic qualities of the sound.

Getting Down To It

Machine code is far more suited to music programming than Basic. On a keyboard notes are played simultaneously but the computer initiates one note at a time. A chord in Basic takes time to create and often sounds as though the notes were pressed in quick succession. This is similar to what occurs with code but the time delay is so short that the notes sound simultaneous.

The first task in programming is to decide how to store the notes. In the program example, the method used is not the most efficient but it does show the principles to best advantage and gives a basis from which to work.

A note consists of a pitch and a duration. To specify duration on the Commodore, the note length is based on the demi-semiquaver which has a duration of one cycle. This means that

the crotchet has a value of eight cycles. In the code this is directly expressed by the number of repeats of the note in the data. Examine the low byte data for Voice 1 and these repetitions cân be seen within the numerical values.

Each note has a high and a low byte so there are two tables relating to each voice.

Voice 1

$C000 – $C148 High frequency
$C150 – $C298 Low frequency

Voice 2

$C400 – $C548 High frequency
$C550 – $C698 Low frequency

Voice 3

$C800 – $C948 High frequency
$C950 – $CA98 Low frequency

The spaces between the tables pairs are occupied by waveform values.

$C2AO – $C3E8 Voice 1
$C6A0 – $C7E8 Voice 2
$CAA0 – $CBE8 Voice 3

The ADSR values and volume are constant throughout so the core routine starts with these at line 310 of the assembly code. Most of the waveforms used by these ADSR values are triangular but Voice 2 uses a pulse occasionally and must have a pulse width set. This is also created at the beginning of the core at lines 450 to 480.

These values are constant and may be set outside the routine as long as any program running with the music does not access the relevant locations. Ideally the routine should store all of the SID values at the commencement of the interrupt, set the music parameters and replace them original values on leaving.

Setting the sound frequencies and waveforms is done by a self-modifying program which increments the load location where the notes are found. Lines 490 to 660 relate to the fetch and poke locations for the pitch parameters and lines 790 to 960 increment the relevant locations within this routine ready for the next interrupt.

The interrupt must be able to repeat at the end of the tune. This means resetting all of the parameters for fetch commands. To do this, lines 670 to 720 test the high byte values for Voice 1 to see if location $C298 has been reached. If the test proves true then control is handed to the reset routine at 730 to 780 before returning from the interrupt.

If the routine was now used as an interrupt, the music would rattle through at a high rate of knots. Some form of tempo control is needed.

Lines 250 to 300 cope with timing by aborting four out of five interrupt calls. A flag is set up at location $CCFF with a value of four. As each interrupt call is made, this flag is reduced by one. When the flag reaches zero it allows a full music interrupt to occur and resets the flag to its original value ready for another countdown.

Lines 1110 onwards sets up the interrupt in the normal way, remembering to include the interrupt enabling structure at 970 – 980.

Musical Chores

The problem with music is that it is rhythmical. This means that timing is crucial and disk or tape access will totally halt the tune but the main enemy is accompanying interrupts.

Chained interrupts can be used alongside the music routine but the effect on the music can be drastic. Interrupts for screen scrolling use long and short routines and care must be taken to allow for any delaying effects which these may cause. Raster linking can assist by further tying the routines down to reasonable lengths.

The inhibitive length of the music data as presented in the example program would obviously use too much memory for most practical purposes. The contents can be greatly reduced if an indexing system is used.

Set up a table of all the necessary frequency values and use a numbering system such as $01, $08, $11 to indicate the lowest note on the table held for eight sixteenth notes (a crotchet) with a triangular waveform. The frequency values could then be found and poked to the relevant registers at the same time as the waveform. The duration can be stored in a location and decreased each time an interrupt is called until it reaches zero. Then the next value can be called up.

Such a system requires quite a lot of work from the interrupt routine but does increase the flexibility of the program.

The data can be pushed under a ROM, to free even more easily available RAM, if the relevant changes are made to location 1 on entering the interrupt and reset on leaving.

Using the Example

The example program can be tested by poking $CCC2 (52418) with $CC (204) and the next location with $10 (16). Location $CC8C should then be poked with $60 (96) and then SYS 52237 will run the tune once.

When all is correct the changed values can be reset and SYS 52480 will run the interrupt. YC

Table 1

Note	Octave 0	1	2	3	4	5	6	7
C	010C	0218	0430	0861	10C3	2187	430F	861E
C#	011C	0238	0470	08E1	11C3	2386	470C	8E18
D	012D	025A	04B4	0968	12D1	25A2	4B45	968B
D#	013E	027D	04FB	09F7	13EF	27DF	4FBF	9F7E
E	0151	02A3	0547	0A8F	151F	2A3E	547D	A8FA
F	0166	02CC	0598	0B30	1660	2CC1	5983	B306
F#	017B	02F6	05ED	0BDA	17B5	2F6B	5ED7	BDAC
G	0191	0323	0647	0C8F	191E	323C	6479	C8F3
G#	01A9	0353	06A7	0D4E	1A9C	3539	6A73	D4E6
A	01C3	0386	070C	0E18	1C31	3863	70C7	E18F
A#	01DD	03BB	0777	0EEF	1DDF	3BBE	777C	EEF8
B	01FA	03F4	07E9	0FD2	1FA5	3F4B	7E97	FD2E

Football Manager II

The world's most famous football game has a sequel. Football Manager caused me more bleary eyes and sleepless nights than any other game. Now it's all going to start again.

Much of the original game is still there, after all, why change a winning formula. You still manage your favourite team and you begin your reign at the foot of the fourth division. Nine skill levels decide the difficulty of the task that lies ahead and you must use your skill to pick the teams that will win you league and cup glory and buy and sell players to fill your squad and you still have to stand helpless on the sidelines while the matches are played.

The first thing you'll notice when you take over the manager's chair is that the players have changed. They



are still rated for skill and fitness but the Peter Withes, Gary Shaws and Tony Morleys of the original have been replaced by Gary Lineker, Ian Rush, Mark Hughes and Brian Robson.

The fitness factor is now rated out of 100 and if a player's fitness drops below 50 he's injured and out for at least the next game. The team selection has now become more meaningful as you must select players to fill forward, midfield and defensive positions. Since there are four positions in each (and of course, a goalkeeper) you can't fill them all which gives you scope to change the formation and man to man markings.

You can also assign two substitutes to bring on at half time to fill any gaps exploited in the first half or open up play by bringing on a winger for a defender.

In the original game the outcome of a match was decided in the difference in skill totals for various areas of the field but now the more realistic player vs player match results in more action and more control over the final result. For example even if the total of your three defenders is greater than the opposing attack; if you leave a skill 3 forward unmarked you're asking for trouble.

The games themselves consist of untimed highlights but instead of just a selection of set moves the players dribble, pass and cross the ball and shoot at a diving keeper. The action is still played at a snailspace, after all this is no International Soccer but even slow action can get the adrenalin going in a crucial promotion or relegation battle.

In between games you can alter the style of play by having extra passing practice and increase or decrease the height and length of the passes and determine whether your side is going to be short passing team like Liverpool or adopt the hit and hope style of Wimbledon and Watford. There's more to this than the style of play as long high balls from defence can bypass a weak defence and get the ball straight to your forward line.

Football Manager II is a tidier game as the program now tells you which of your players scored the goal including midfielders, money that you receive at the end of the season to bolster your failing bank account that you squandered on a third goalkeeper comes now in the form of shirt advertising deals. The deals that you're offered vary considerably and the number of deals depend on your management rating so if you're doing badly you should take the first deal offered because if you turn it down there might not be another.

A longer 23 match season and two cups (FA and League) to play for will suit Football Manager fans who will wallow in every game but may put off others who prefer less thought and faster action.

T.H.

Touchline:

Title: *Football Manager II.* ***Supplier:*** *Addictive Games (Prism Leisure), Unit 1, Baird Road, Enfield, Middlesex, EN1 1SJ.* ***Tel:*** *01-804 8100.* ***Machine:*** *C64.* ***Price:*** *£9.99 (Ca) £14.99 (Disk).*

File Extension



Now you can load and run files from a directory in a single key press with this basic utility

By James Kliemt

Normally after listing a directory, loading a file involved moving the cursor to the file name, typing LOAD, cursoring through the file name, typing either ",8,1" or "8", spacing over the three-letter file description and finally pressing RETURN. File Extension permanently writes the load description to the end of any file you nominate. To load a file thereafter, you simply list the directory, cursor up to the file name and push SHIFT & RUN/STOP.

File Extension will work on a Commodore 64 or 128 in 40 or 80 column modes. The program is in Basic, therefore there are no special instructions – just type it in and save it as you would a normal program.

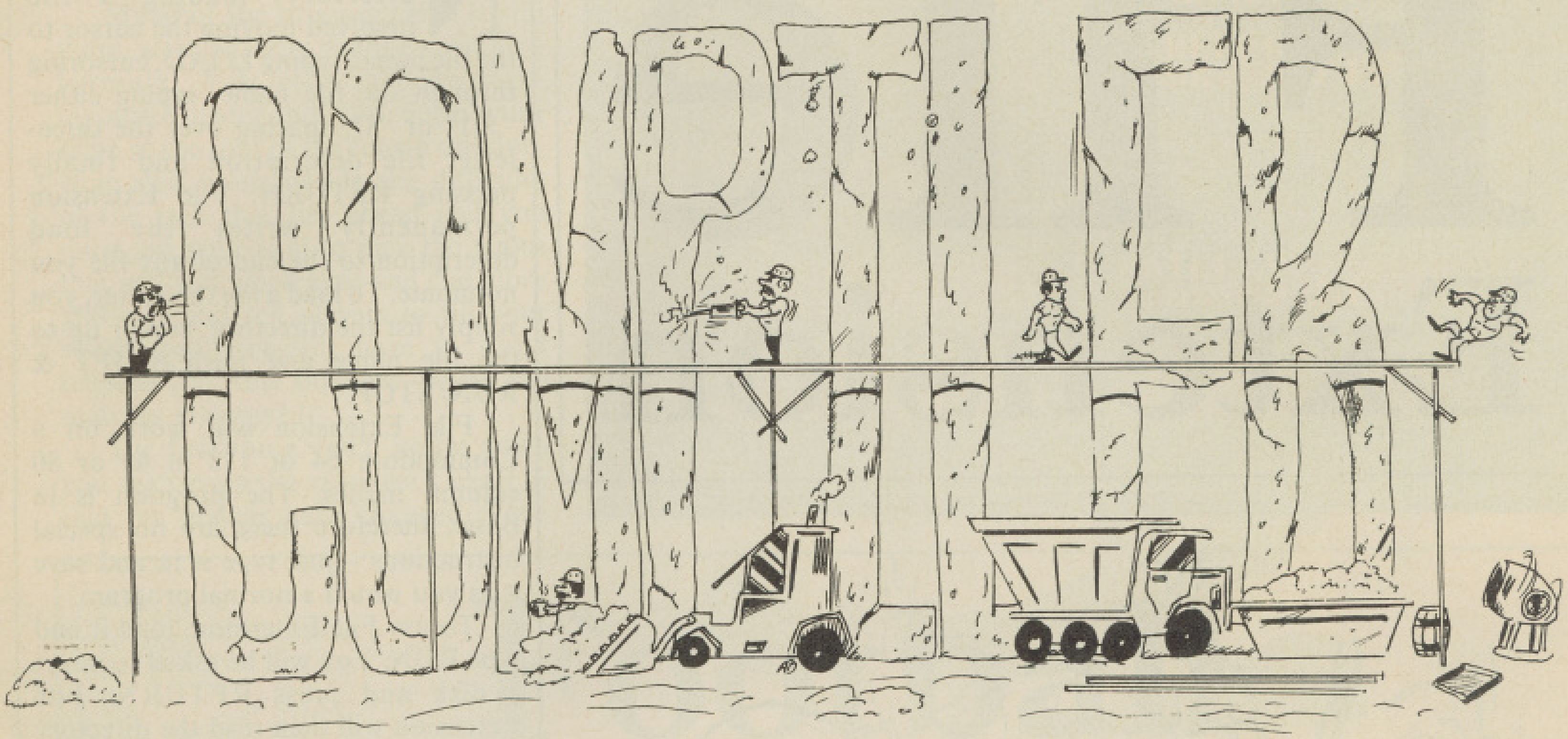
To use File Extension, load it and type RUN. You will be asked to insert a disk and press RETURN. File Extension will then read the directory and print it to the screen. You can stop the directory at any time by pressing SPACE. If it is finished reading the directory or you have pressed SPACE, you will be taken to the main menu. Here you are presented with the current file name displayed in the top left hand corner of the screen and a list of options. Use cursor up and down to view other file names in the directory. Pressing HOME will take you to the first file name in the directory and SHIFT HOME will take you to the last.

Once you have selected the file you wish, press the appropriate key. If you press 1, the computer will add ,8: to the end of the file name – the load description for any basic file. Pressing 2 adds ,8,1 to the file name – for binary or machine language files. Pressing 3 will result in a : being added to the file name. This is for 128 files.

A number of other options exist. Pressing the minus key will erase the current file. The @ key allows you to access disk commands such as validate, new, etc. R lets you rename the current file and P will list the directory to the printer. Any time you wish to view the disk status, simply press S. Once you have completed operations on a disk, press SPACE to return you to the insert disk option.

See listings on page 61

Constructing a



We hope your typing fingers are in good shape as we launch into the next two programs in the FCL compiler series – the code generator and the assembler

By Steve Carrie

Although codegen may look rather complicated, its operation is very simple. It reads the .SFC file created by compile and generates an assembly-language source file .ASM. Codegen is able to recognise the operation codes in the pseudo code file and how many opcode bytes each should have. (These codes were listed last time.) It then uses a library of preset assembly-language lines to make up the output file. Some of these library routines simply make a call to the SYSLIB library, others are several lines long and perform data transfers between the system variables and other memory locations.

Codegen is also responsible for making the program header to allow the final runtime file to be loaded and run as if it were a BASIC file. If you already have a disk-based assembler, you may not need to use the assemble program at all since it is easy enough to change the preset routines in codegen to suit your particular program.

Most of the work done by codegen is performed in subroutines, the first section of the program simply diverting control as necessary. The first task is to read in the two data files containing symbol and string information (the .SYM and .LTR files). These are entered into tables in a similar format to those in compile. The next task is to open the work files and generate the program header. This header contains the org directive for the assembler and this should be changed if the program is to be loaded at an address other than the default start of BASIC at 2049 ($0801). Next, the symbol and literal tables are processed. The tables are updated with information regarding the position of variables within the program. Codegen knows how much memory should be allocated to each type of variable and it also generates the literal strings in the correct format. Once this is done, work can then begin on the program itself.

The code is read one line at a time and control is passed to the pseudocode processing subroutine which in turn passes control to the appropriate routine to generate the assembly source text. As you may recall, some codes require operands and each routine knows how many operands it needs and reads them as required. There are two distinct blocks of routines; those handling pseudocodes 0-33 and those handling codes 128 to 191. The latter set of codes are the keywords.

During code generation, the program keeps track of how many lines are being generated into the .ASM file. The only problem that may arise here is if the disk space becomes scarce, the process will abort.

If, during code generation, a "Not Implemented" message appears, some illegal opcode has been found. This may indicate an error in compile. While on the subject of the opcodes, you will need to add extra lines to codegen if you decide to extend the compiler system with new commands.

The compile program should automatically load and run codegen for you (assuming the compilation was

error-free). When asked for the filename, you should enter exactly the same as you did for compile.

Codegen will report the number of lines being generated as it processes the pseudocode file. Upon completion, codegen will load and run the FCL ASSEMBLE program.

The only possible error is the "not implemented" message which indicates that an opcode was not recognised. This may mean one of two things:

- there is an error in compile, or...
- You have added new commands to compile without adding the necessary handlers to codegen.

The Assembly Stage: ASSEMBLER

Assemble is a very basic two-pass assembler written entirely in machine code and is presented here as a BASIC loader. It must be loaded and run as if it were a BASIC program only at the default BASIC start address of 2049 ($0801). The reason for writing this program in machine code will be obvious when you run compile, BASIC would be very very slow... In order that the program loads at the correct address, you must ensure that it is constructed at 2049. *Before you start typing in the BASIC loader, execute the following command in direct mode.*

```
POKE 8192,0:POKE 44,32:NEW
```

This moves the start of BASIC upwards in memory to 8192 decimal ($2000 hex). If you are entering the program in stages, make sure that you type this command every time BEFORE you start and make sure you haven't got EDIT installed!

Since I have had considerable assembler-writing experience, I didn't really need to spend time working out the routines required and coded directly into machine code. Actually, the original version of this assembler was written on a PLUS/4, as was the original version of compile, and converted across to the 64.

The next bit is a short user manual for the assembler which is entirly disk-based in its operation; i.e. there is no assemble-to-memory option available.

FCL Assembler User Manual

In the following document, **boldface** characters are used to represent valid assembler directives only. This program will switch the character set to lowercase mode and it should be noted that uppercase characters are only allowed in literal strings or comment lines.

Getting Started

The program should be loaded as would a normal BASIC program using the LOAD command. If you are using assemble as part of the FCL Compiler System, the codegen program will automatically load and run the program for you.

The program file to be assembled should have extension .ASM by default. The program will request input of the filename; you should only enter the first part of the name e.g. to assemble PROG1.ASM you need only enter PROG1 when asked for the filename. The assembler will produce a file with extension .EXE; e.g. for the above example, PROG1.EXE.

During assembly, information will be printed on the screen relating to the current program state. During PASS 1, no messages other than the pass message will be output unless an error occurs whereupon an error message is printed and assembly aborted. During PASS 2, the program will be listed as it it processed. Again, any errors will cause an error message to be output and the assembler will stop.

On completion of a successful assembly, information relating to the start and end addresses of the program will be printed. The start address of the program is deemed to be the load address. Runtime .EXE files should be loaded using a specially written loader or use secondary address 1 in a BASIC LOAD command; e.g. LOAD "PROG1.EXE",8,1

Directives

There are seven directives valid with this assembler:

- byt – assemble a byte value. May also be used to assemble a line of text delimited by single quotes (').
- wor – assemble a word value (2 bytes) in 6502 lo-byte, hi-byte order.
- eqz – Equate zeropage. Explicitly define a symbol as type 'byte'.
- eqa – Equate absolute. Explicitly define a symbol as type 'word'.
- org – Set code origin. Sets the assembly address and therefore the load address of the a assembled program.
- res – Reserve a block of memory. Memory bytes are initialised to zero.
- (full stop) Define a symbol. May be followed by an equate or either byte or word type. If no equatea follows then the current assembly address is used; i.e. defines a line label rather than a symbol.

Operators

The assembler accepts normal 6502 assembly language notation and addressing modes. The hash (#) denotes an immediate operand and the symbols < and > may be used to define lo-byte or hi-byte operations. A full list of operators is given below.

Operator	Action	Example of Use
<	lobyte	lda #< symbol
>	hibyte	ldx #> symbol
+	add	lda symbol+1
-	subtract	ldx symbol-1

Numeric Types

Only decimal and hexadecimal types are catered for. A hexadecimal number must be prefixed with a dollar or ampersand while a decimal number need no prefix at all. For example:

$8000 as in lda $8000 means address 8000 hex (32768)
8000 as in lda 8000 means address 8000 decimal

Error Messages

Error messages may be printed out by the assembler during either pass 1 or pass 2. Errors during pass 1 are normally syntax-type errors where the programmer has misspelt a word or used an illegal character sequence. Errors during pass 2 include those of pass 1 and also symbol-type errors such as relative branch range errors.

These error messages are listed in Fig 1. and are printed in either of two formats. During pass 1, the line in which the error occurred is printed and the error message is displayed below

it. During pass 2, the program is being listed anyway so only the error message is displayed.

Assemble Error Messages

Undefined symbol error – indicates that a symbol has been referenced but has not been defined using the directive (full stop).

Redefined symbol error – indicates that a symbol has been declared twice or more times.

Mnemonic not recognised – the mnemonic found was not a standard 6502 type or assembler directive.

Bad symbol error – means that a symbol was syntactically incorrect.

Illegal Operand field – occurs when an operand is syntactically incorrect.

Illegal Mnemonic field – indicates that a mnemonic was expected but something else was found instead.

Missing operand error – an operand was expected but was not found.

Disk file error – file is missing or possibly the disk is faulty or full.

Syntax error – this is a general message, possibly indicates a bad operator.

Illegal quantity error – indicates that a numeric literal was out of range, i.e. too big.

Illegal addressing mode – indicates that you have tried to use an instruction in an incorrect addressing mode.

Not X or Y index – only X and Y index registers exist on the 6502. You have specified an incorrect index.

Symbol table full – assembly cannot continue due to lack of symbol workspace.

Branch range error – relative branch instructions have a range of -128 or +127 bytes. You have exceeded these limits.

Example of an assembly language source program.

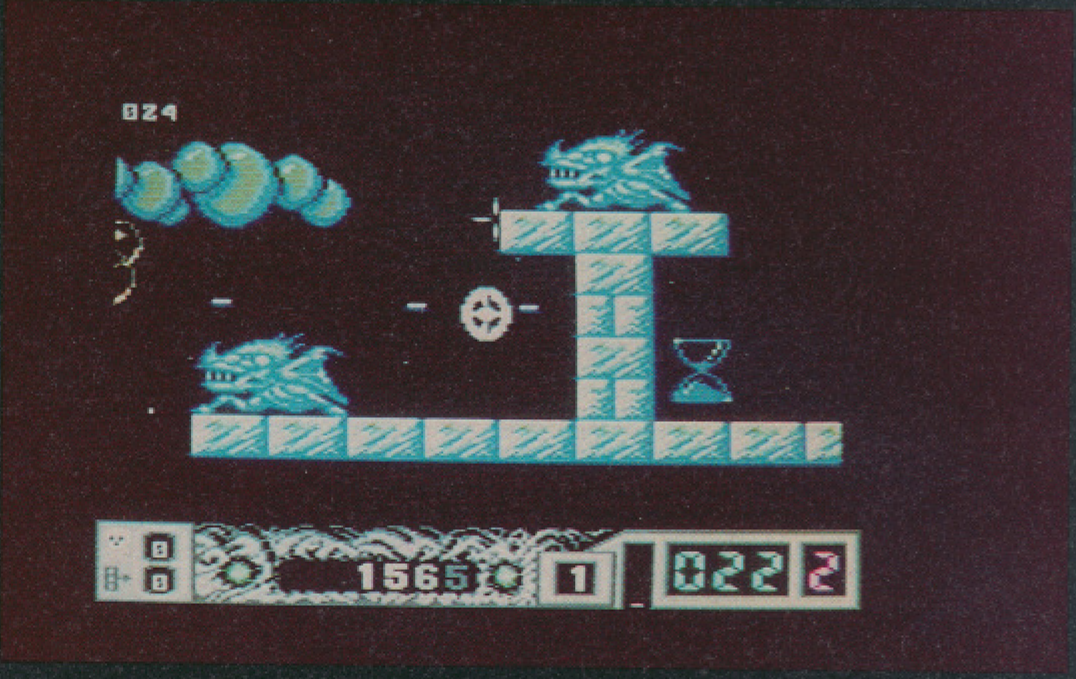
```
10   ; Example program
20   ;
30   org $c000
40   .border eqa $d020
50   .screen eqa border+1
60   ;
70   .start ldx # 0
80   stx border
90   stx screen
100  inc border
110  .loop1 inc screen
120  lda screen
130  cmp # $0f
140  bne loop1
150  inc border
160  stx screen
170  lda border
180  cmp #15
190  bne loop1
200  .exit
210  rts
```

Note the use of the symbol declaration directive (full stop) and the combination of symbol label and instruction in line 110. Lines 200-210 show how you may place these on separate lines. Remember that the org directive not only sets the code origin, it also sets the file load address on the disk. This is important because the address defaults to $0000. Loading a file at this address will almost certainly crash the machine!

So now you have EDIT, COMPILE, CODEGEN and ASSEMBLE. Next time I will present the final part of the system, the SYSLIB runtime library and some example programs will also be included.

See listings on page 61 YC

Netherworld



I used to think chocolate milk was addictive! Netherworld is definitely a game to test your willpower as much as your joystick skills. I haven't been so hopelessly addicted to a game since Boulderdash (to which this game owes more than a passing resemblance). Jukka Tapanimaki may be testament to the programmer's art in Finland, but this man is obviously in need of psychiatric help!

Trapped in a fantasy world with nothing more than your multi-firing gyrosphere to protect you, the only way back to normality (?) is by battle and bribery. Acid, bubble-belching dragons are your worst enemy, but never forget that time is no friend either. Steer your ship around the maze, collecting diamonds and egg timers (the latter extends your time limit in your favour) until you have enough diamonds to bribe the guardians of the teleports into letting you proceed. Until then, you can only use the teleports for 'local' trips, these being quite useful once you've worked out where each one deposits you. Shooting acid bubbles can produce items that when collected, help you on your way, increase your score, or merely serve to hinder you.

After succesfully completing level one, a devilishly tricky bonus round is your next task, although completion is not obligatory. By pushing moveable rocks into positions, the flying blob is directed into the converter grid a valuable extra life can be collected.

Levels two and beyond are infinitely more difficult with the inclusion of 'nasties' generators, alien eggs, moveable rocks and various other hinderances.

Although the game play is reminescent (to me, anyway) of Boulderdash (collect-all-the-diamonds-and-the-exit-before-the-clock-runs-out), the graphics belong to the age of Uridium (ultra-smooth, ultra-fast scrolling) and I0 (imagine-your-worst-enemy's-worst-nightmare). Your gyrosphere responds well under joystick control, its 'natural' inertia took quite a bit of getting used to – a lot like Paradroid (I don't like drawing comparisons like this but sometimes it's the only way!). Chancing the mystery bonus (after shooting acid bubbles) can provoke some weird results – your gyrosphere can suddenly respond back to front and upside down (inverting your joystick gets you out of this quite nicely) or you could lose control completely for a while. On the plus side, you could gain extra speed, a demon killer, or be able to knock out bricks. The latter two features are cumulative not to mention essential to solving the higher levels.

Soundwise, the inter-game music narrowly escapes 'disgustingly bad' but knocks spots off one or two Amiga soundtracks I could call to mind! Sound effects (muzee-speek ekwivelent = SOWNDEFX) are useful rather than tuneful – and so they should be.

Well done Hewson (nice press do), more of the same please! This Finnish geezer is pretty hot stuff – the bonus round is probably worthy of a game on its own! It's pretty rare for one of my reviews to have nothing but praise, so take a pat on the back all round. I only hope I can squeeze my meals in between attacks of Netherworld.......

F.R.

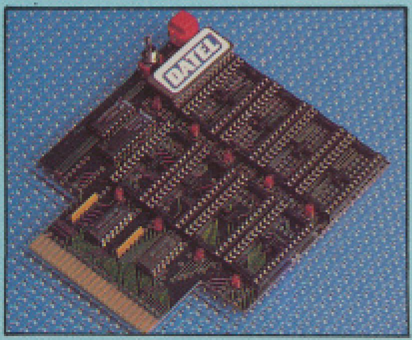
Touchline:
Product: *Netherworld.* ***Supplier:*** *Hewson, 56B Milton Trading Estate Milton, Abingden, Oxon OX14 4RX.* ***Machine:*** *C64/128.* ***Price:*** *£7.99 (£14.99 disk).*

DATEL ELECTRONICS

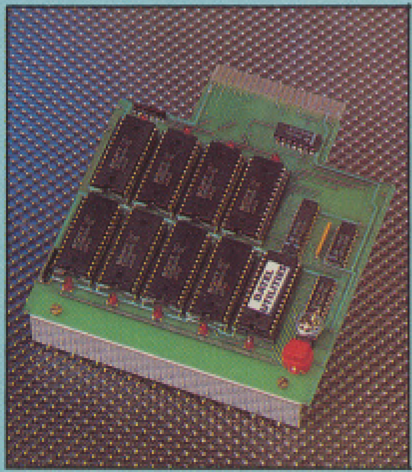
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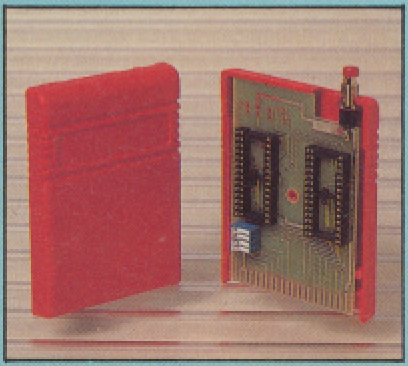




RESET CARTRIDGE

- Unstoppable reset button.
- Resets even so called "unstoppable" programs.
- Add pokes from magazines etc.
- Fits in cartridge port.
- Simply plug in.

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16K EPROM BOARD

- Accepts 2 x 8K EPROMs.
- Switchable to configure as 2 x 8K or 16K or off.
- On board unstoppable reset.
- Full instructions.

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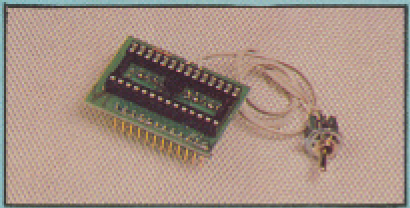
- Quickly and easily double your disk capacity.
- Use both sides of your disks.
- Simple to use.
- Takes seconds.

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- Copies standard software as well as errors 21-29 and upto 40 tracks.
- Full disk error check in eight seconds.
- Full disk verify against ram in fifteen seconds.
- A must for clubs, user groups etc. How else can you copy over 250 disks and hour for less than £100.
- Comes complete with on/off switch and reset button.
- Fitted in minutes – no soldering usually required.

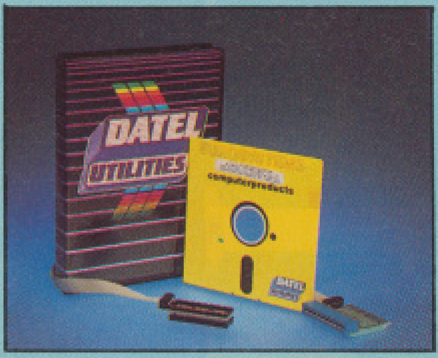
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- Now you can have all your different systems available at one time.
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- Fitted in minutes.
- 5-Way Board

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DEEP SCAN BURST NIBBLER™

- The most powerful disk nibbler available anywhere, at any price!
- Burst Nibbler is actually a two part system – a software package **and** a parallel cable to connect th 1541/1570/1571 to 64/128 (state type).
- What gives Burst Nibbler its power? Conventional nibblers have to decode the data from the disk before it can transfer it using the serial bus – when non standard data is encountered they are beat Burst Nibbler transfers data as raw GCR code via the parallel cable without the need to decode it so yo get a perfect copy of the original.

- Will nibble upto 41 tracks.
- Copy a whole disk in under 2 minutes.
- Full instructions.
- Regular updates – we always ship the latest.
- Fitted in minutes – no soldering usually require
- Full or ½ tracks.
- No need to buy parallel cable if you have Disk Demon/Dolphin etc.
- Cable has throughbus extension for other add ons.

- Whether to choose FastHack'em or Burst Nibbler? Fast Hack'Em is unbeatable value as an "all-rounder" – with nibblers, 1 or 2 drive copy, format, file copy, 1571 copy etc. etc., so if you have a more general requirement perhaps FastHack'Em is for you. Burst Nibbler is a pure nibbler second to none, for the reasons stated. So if it's just making backups you are interested in, there is no other product to beat it.

ONLY £24.99 COMPLETE

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- Burst Nibbler is the most powerful disk copier available – but there are still a few programs with very complicated protected, which makes it impossible to nibble copy. The Burst Nibbler Param Disk contains routines to copy individual programs.
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- Simple to use – just nibble the disk run the individual parameter for that program and the special routine will pr a perfect working copy – in some case will even de-protect it!
- Comes complete with "Super Serial Nibbler" program for users who can't f parallel copier such as Burst Nibbler to drive (Excelerator, Oceanic etc)., not as as Burst Nibbler but when used in conjunction with parameters its formid
- Remember – this disk is by no means a must for Burst Nibbler owners since it already copes w over 90% of Software. But for those who want everything this is it. Also for none Burst Nibbler own you get a "Super Serial Nibbler" which together with the parameters is a powerful utility.

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- HEADER/GAP EDITOR – Decodes and displays ALL header information including off bytes and header gap. Rewrite the entire header and header gap. Renumber sectors. Also edit any sector tail gap.
- DISK LOOK – Sort directory. Recover lost files. Display file start/end addresses. Disassemble any file program directly from the disk to SCREEN or PRINTER including undocumented opcodes. Edit Bam. Much, much more.
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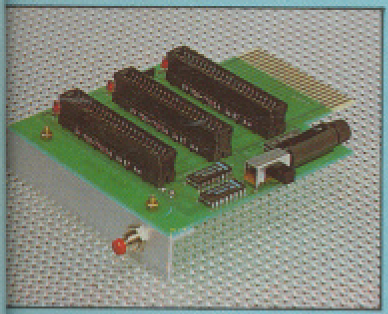
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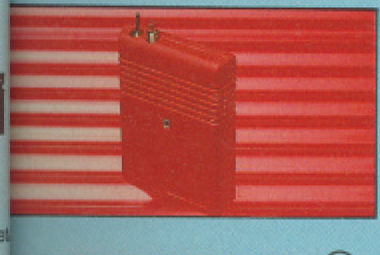
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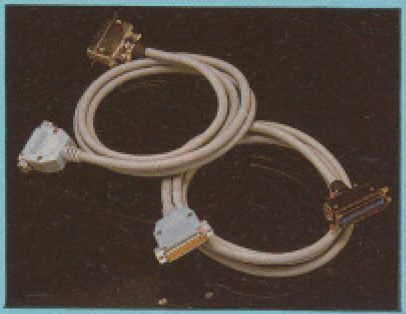
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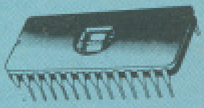
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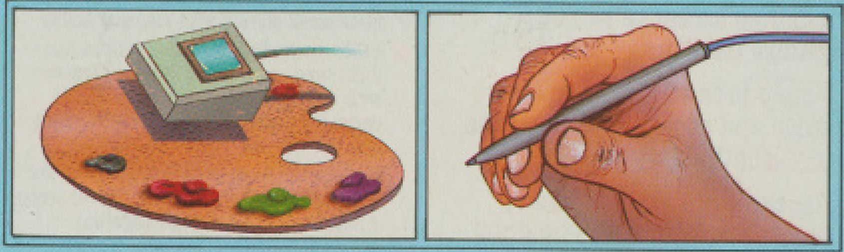


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Turbo Rom II is a replacement for the actual kernal inside your 64. It provides superfast load/save routines.

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- Improved DOS support including 10 sec format.
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  - Range of brushes ● Airbrush ● Rectangle ● Circle ● Rubberbanding ● Lines ● Freehand
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  - Cut and paste allows shapes/windows/pictures to be saved to/from tape/disk.
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Complete Blazing Paddles & Lightpen **ONLY £24.99**

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- Com-Drum software is available separately at **£9.99** to turn your Sampler II into a Com-Drum system as well as a sampling system.



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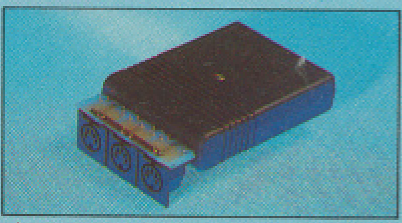
- Now you can turn your computer into a digital drum system.
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- 8 digital drum sounds in memory at one time.
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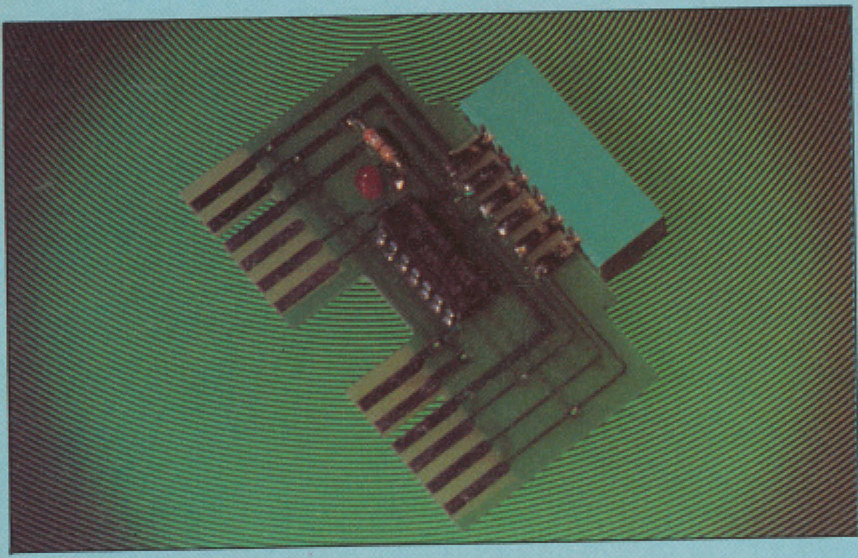
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A Full Midi Interface for the 64/128 at a realistic price

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– 5 Axis Movement
– Full Function

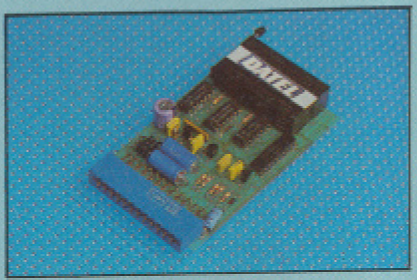
- Explore the fascinating science of Robotics with this full feature Robot Arm.
- Human like dexterity – with 5 Axis of movement it is so versatile. It can manipulate small objects with amazing ability.
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- Comes with Accessories including 'Finger' Jaws, Magnetic Attachment, Shovel Scoop, 4 Stabilizing Suction Base Legs, etc.
- Uses 4 HP2 batteries (not supplied) to power motor movement so uses no computer power.
- Self contained, ready to use (except batts, joysticks).

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INTERFACE OFFER

- Unique Software/Hardware package to allow you to interface your computer with the Robotarm.
- Train mode allows you to store and then repeat movement sequences.
- Very easy to use.
- This Interface is not needed to use the Robotarm but interfacing with your computer has great possibilities

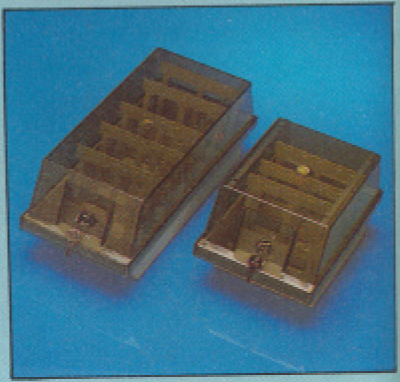
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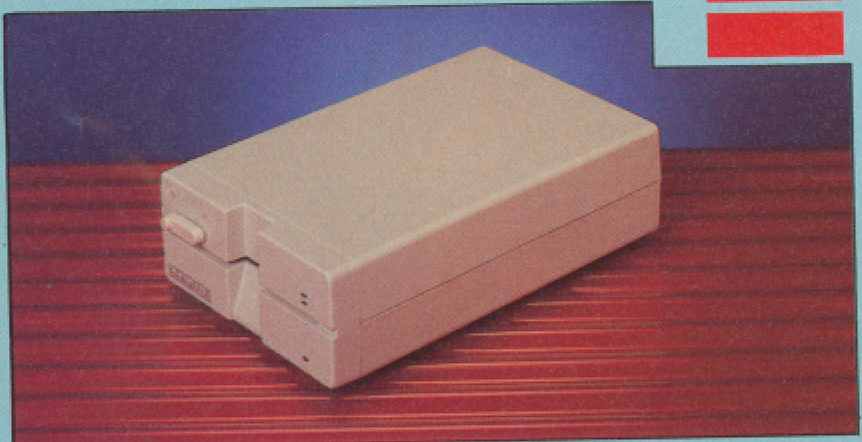
- A top quality, easy-to-use EPROM programmer for the 64/128.
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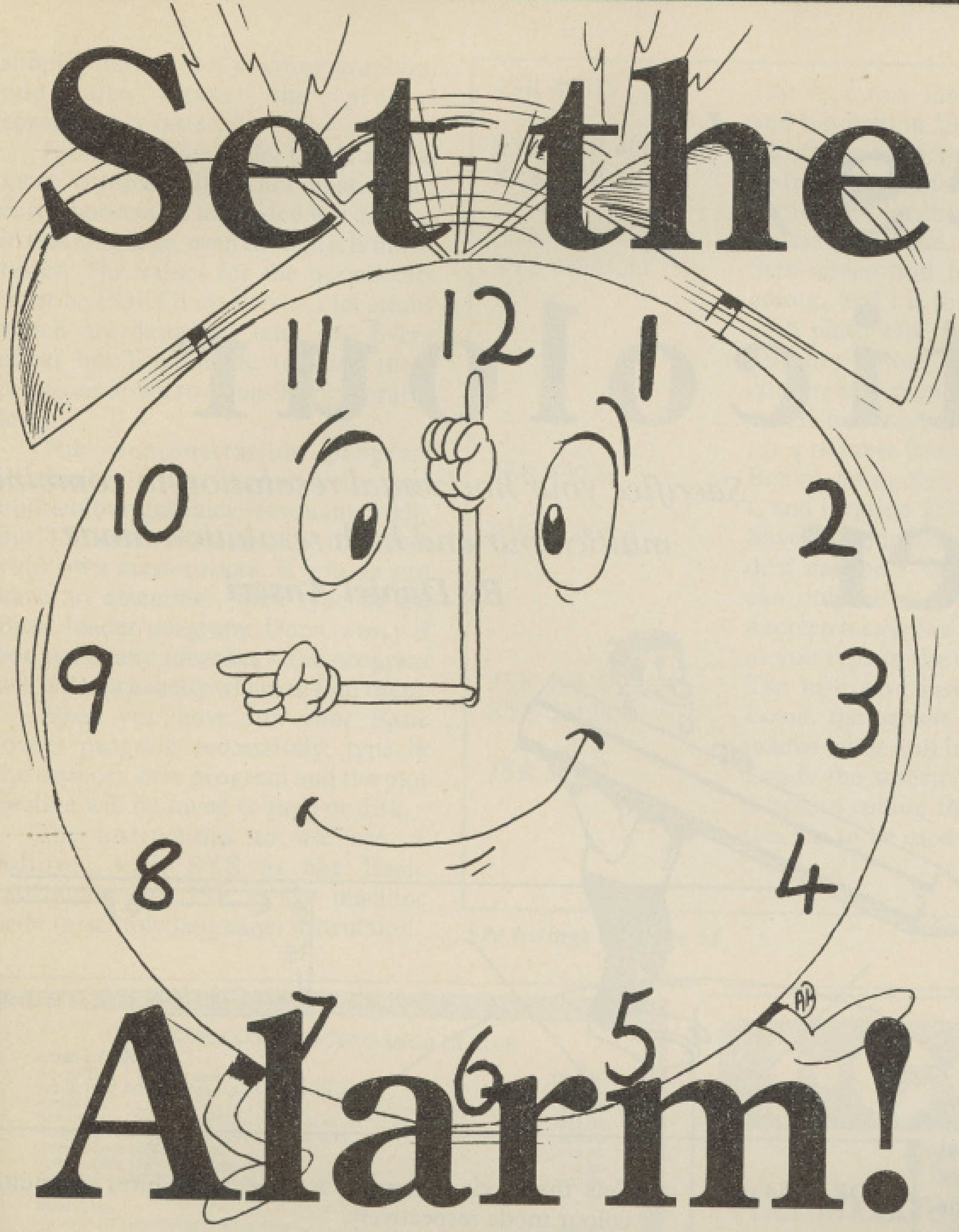
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Set the Alarm!



Has there ever been a time when you've been so absorbed with programming your 64 that you've been totally unaware of the world outside? If so then help is at hand with this routine. Just type in Alarm and you'll never miss the start of your favourite telly program again or even worse last orders at the Dog and Fox

By Nick Gregory

Alarm turns the 64 into a digital alarm clock while still allowing you to use the computer normally. The program works on interrupts, checking every 1/60th of a second to see what time it is and whether or not its time to sound an alarm. There are four ways to use Alarm which I will demonstrate with examples:

```
SYS 49152
```

This turns off the Alarm routine and returns the C64 to normal.

```
SYS 49152,"P0800", "P1045", "LAST
ORDERS NOW"
```

This sets the actual time to 8 o'clock pm and the alarm to 10.45pm. When 10.45 is reached then the message "LAST ORDERS NOW" will be flashed in the top left hand of the screen. The message will be flashed on the screen until you use the first command (or RUN/STOP and RESTORE) to turn it off. You can set the time or alarm to am by using an 'A' rather than 'P' in the time string. For example "A1000' is 10 o'clock am.

The time strings must start with either an 'A' or a 'P' otherwise you will get a syntax error and they must contain the time in the format HHMM within the natural ranges otherwise you will get an illegal quantity error. The message can be anything you want up to 26 characters but it shouldn't contain control codes or cursor controls, just ordinary printable characters. Again if you exceed 26 characters you will get an illegal quantity error.

```
SYS 49152, "P0800", "P1045", "LAST
ORDERS NOW",1
```

This is exactly the same as the example above except that the time will be continually displayed in the top right hand of the screen. The time is printed in hours, minutes and seconds though you can not set the time to seconds. An 'A' or a 'P' is also displayed to tell you if it's am or pm. If the final value in this example is greater than one you will get an illegal quantity error, if it is zero then the command is the same as in the last example:

```
SYS 49152, "A0000", "A0010", "TEN
MINUTES ARE UP"
```

This example shows how you can use Alarm to time specific periods. The alarm will go off in ten minutes time. It doesn't matter in this case if you use am or pm but the routine expects one or the other. Putting a 1 as the final value (as in the last example) will display the clock continually.

Before you set the times you should know how the clock works. The clock will tick away from A1200 to P1200; there are no A0010 except as I've just described above. For example, five minutes past mid-day is written as P1205 and five minutes to mid-day as A1155. Likewise five minutes past midnight will be A1205.

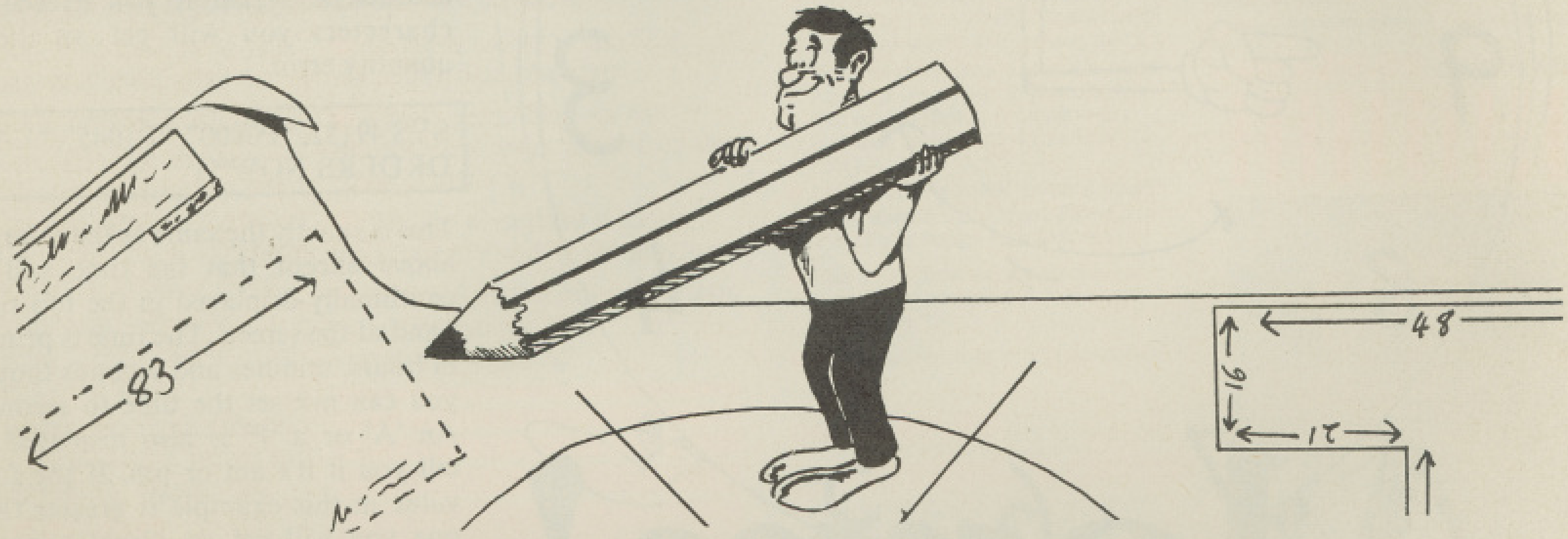
As Alarm is an interrupt routine you should be extra careful when typing it in because the 64 will most certainly hang up on you if you've made a mistake and remember the golden rule: SAVE BEFORE YOU RUN.

See listings on page 61

Hires/ Multicolour Plotter

Sacrifice your horizontal resolution to combine multicolour and high resolution mode

By Daniel Ansari



None of the plot routines that I have so far seen in magazines were intended for use by the machine code programmer, neither were they able to be used in multicolour mode as well as hires mode. Multicolour mode is a nice feature of the Commodore 64, allowing up to four different colours to be used in a single character square, unlike the two colours in high resolution mode. There is, although, a sacrifice in horizontal resolution, which is halved to 160 pixels.

The routines available plot/unplot points, test them, draw/undraw boxes of any size and shape, clear the hires screen, enter hires mode, enter text mode, colour the whole screen, and load and save screens.

When used from Basic, the only POKE command needed is to tell the routine whether you wish to use hires mode, or multicolour mode. All the other instructions from now on are simple SYSs, with the parameters separated by commas. I have eliminated the need for several POKE instructions as well as an SYS, when one SYS and no POKEs greatly

POKE 254,m	Sets the mode, where m is 0 or 1 for hires or multi-colour mode respectively.
SYS 49152,x,y,c,b	Turns a point, of co-ordinates (x,y), on or off. x is a number from 0-319, y a number from 0-199, and c the point colour; in multicolour mode it is a number from 0-15; in hires mode it is a number from 0-255 calculated by 16* point colour (0-15)+ background colour (0-15) b is the brush; in hires mode 1 or 0 for on or off; in multicolour mode 0 for off, or brush number 1-3.
JSR 49193	The machine code version of the above. Before using this instruction, store x in locations 50177-8 in the order LSB, MSB, and store y in 50179. c and b should be put in locations 50183 and 50184.
SYS 49340,x,y	Tests a point of co-ordinates (x,y). The number in location 50192 is 0 if the point is off, and greater than 0 if it is on. In hires mode, the number in 50193 gives the point colour and background colour together. The point colour is calculated by INT(n/16), where n is the number. The background colour is n-INT(n/16)*16 and can be calculated even if the point is off. In multicolour mode location 50193 contains the point colour (0-15).
JSR 49378	Tests a point. Only x and y are needed in locations 50177-9.
SYS 49634,x,y,w,h,c,b	Draws/erases a box of top left co-ordinates (x,y) where w is the width (0- 319-x) and h is the height (0- 199-y).

simplify the task of creating graphics, and also make the process considerably faster.

From machine code, this is a little more complex. It is not possible to enter parameters separated by commas in this language, even though it is much faster. The values for the parameters must be POKEd into certain locations which are described later on. Every effort has been made to keep these locations down to an easily memorable level.

The demonstration program illustrates the capabilities of multicolour graphics reasonably well, but I'll leave it up to you to create your own masterpieces. If you do not have an assembler, then type in the Basic loader program. Don't worry if you make any mistakes – the program will tell you exactly where to find them.

When you have run your Basic loader program successfully, type in the memory save program and the plot routine will be saved to tape or disk.

The instructions to use are as follows, with SYS as the Basic instruction and JSR as the machine code (assembly language) instruction:

JSR 49675	The m/c box instruction, where w is held in 50180-1 and h is held in 50182.
SYS/JSR 49867	Clears the hires/multicolour screen at 8192.
SYS/JSR 49897	Enters hires/multicolour mode, depending on the contents of location 254.
SYS/JSR 49926	Enters text mode.
SYS 49951,s,t	Sets screen and border colours, where s is the screen colour, and t is the border colour. In multicolour mode each parameter ranges from 0-15; in hires mode s is a number from 0-255, calculated by 16* point colour+background colour (the colours of all the points on the hires screen can be changed with this instruction); t is a number from 0-15.
JSR 49974	Before using this instruction, load the x register with t, and location 253 with s.
SYS 50005,d	Saves the hires/multicolour screen with device number d. d can be 1 or 8, for tape or disk. This instruction can only be used in program mode; this is because if a screen is saved in immediate mode it becomes corrupted as you type in the command.
JSR 50019	The m/c save instruction. Load the x register with d.
SYS 50128,d	Loads the screen. Please note that the screen can be loaded while still in text mode.
JSR 50142	Loads the screen from m/c. Load the x register with d before calling this routine. As with the save routine, this has to be used in program mode.

See listings on page 61

Making Music

Commodore tell us that the SID (Sound Interface Device) Chip is a single-chip, 3-voice electronic music synthesiser/second effects generator compatible with the 6510 and similar microprocessor families. It has the following features: three tone oscillators in the range 0-4 kilohertz (one hertz is, you may recall, one cycle per sound); four waveforms per oscillator, and these are of course our familiar triangle, sawtooth, pulse and white noise; three amplitude modulators, with a 48 decibel range; three envelope generators, featuring exponential response, an attack rate varying from two milliseconds to eight seconds, a decay rate varying from six milliseconds to 24 seconds, a sustain level varying from 0 to the peak volume level, and a release rate which also varies from 6 milliseconds to 24 seconds. They all, of course, vary from zero milliseconds to whatever the maximum setting might be. This was all seen to ample effect in the ADSR settings program.

Oscillator synchronisation, which we have simply referred to as synchronisation and which requires the voice being synchronised to be at a lower frequency than the one it is being synchronised with, but preferably at a higher frequency than zero!

Ring modulation, which we have dignified with the full term and which, as we have seen, requires a triangle waveform in order to operate properly.

Filtering techniques, which again have been covered in some detail. Commodore call them oscillators, we call them voices!

However, these are just words, and actions (or at least tables) speak louder than words. The Commodore 64 manual obligingly gives us the high and low value frequency settings for a range of notes, but in order to obtain the frequency value of an unspecified note in a form suitable for turning into a high and low value frequency we must use the formula:

F=Freq/0,06097

where Freq is the value we want, and F is the frequency of the note in question. Having got Freq we can find the high and low value frequencies (FH and FL) from the following equations:

FH=INT(F/256)

and FL=F-(256*FH)

All this assumes that F is an integer value, by the way.

The ADSR settings, with talk of milliseconds and seconds, sounds all very grand, but in terms of actual numbers and values to be POKEd into memory the following table tells us all we need to know:

Decimal	Hexadecimal	Attack	Decay/Release
0	0	2	6
1	1	8	24
2	2	16	48
3	3	24	72
4	4	38	114
5	5	56	168
6	6	68	204
7	7	80	240
8	8	100	300
9	9	250	750
10	A	500	1.5 secs
11	B	800	2.4 secs
12	C	1.0 secs	3.0 secs
13	D	3.0 secs	9.0 secs
14	E	5.0 secs	15.0 secs
15	F	8.0 secs	24.0 secs

The times given are all in milliseconds, unless otherwise specified.

You'll see from this table that not every setting is possible, although the number of different ADSR settings available (256 * 256, or 65536) should be more than enough for most people. It isn't, for example, possible to get an attack rate of 30 milliseconds, or a decay rate of 500 milliseconds, but such minor problems should really be overlooked in the face of what we have got.

Combine the number of possible ADSR settings with the number of different notes we can play, the variations on ring modulation and synchronisation, and in particular the number of different filter types and filter settings (combining resonance and cutoff frequencies of different values) and you'll soon realise that it is a foolish man who can claim to know all about the SID chip and its workings.

Conclusion

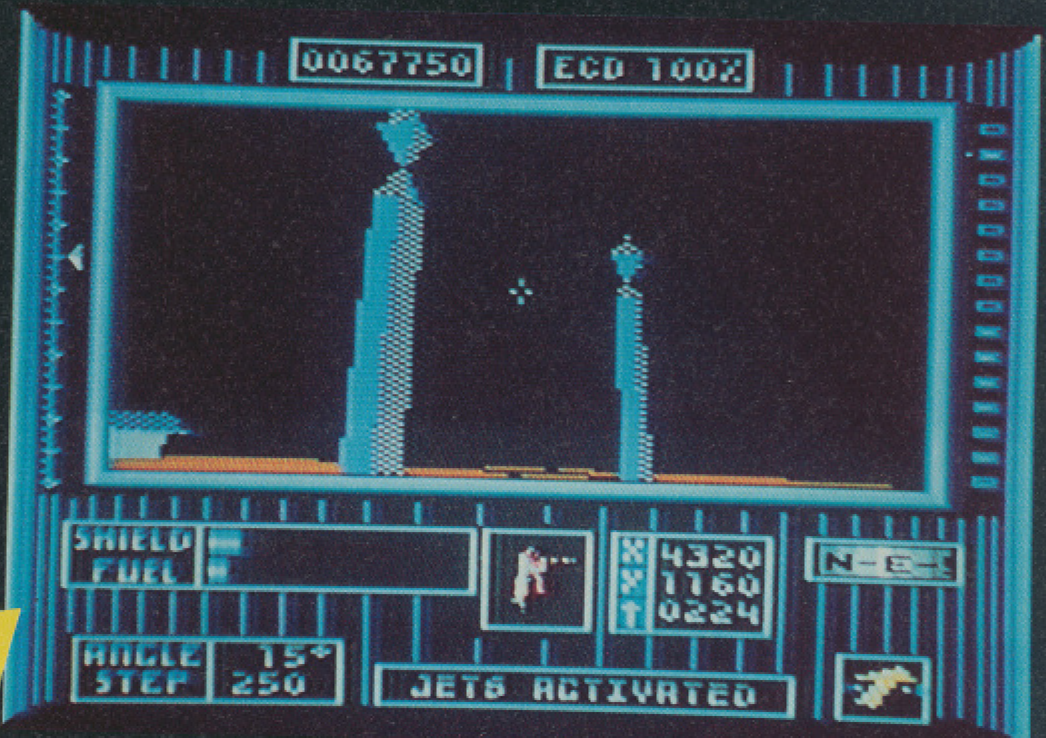
During the course of this foray into the inner workings of the SID chip we have encountered many musical marvels, and have come close to talking about everything that the chip is capable of doing. Envelopes, modulators, synchronisers, filters, have all been discussed, and the sound effects and musical tunes that we can produce have a virtually infinite range.

The major programs presented will help you to understand how the chip functions, and how its various features can be utilised to best effect.

However, in the end it is of course up to you, the user of the chip, to get the best out of it, and the only way to do that is by experimenting. No one can hope to commit to memory all of the wonderful effects that are available to us when using this chip. No, the only route is through continuous experimentation, fiddling about with programs, changing the values stored in registers, altering what goes where and seeing what happens as a consequence.

I encountered my first, very humble, 'synthesiser' program for the Commodore 64 back in the early months of 1983, over four years ago. I still use that program, and I'm still learning how the chip itself operates, and how I can ever possibly hope to understand all its inner workings and create every sound it's capable off. If you've just started, try not to despair!

See listings on page 61



Dark Side



In a month of sequels (Football Manager II, The Games – Winter Edition) non is more impressive than the sequel to Incentive's Driller, Dark Side.

This is the second in the games to feature the Freescape 3D system that creates solid images and gives you millions of possible views of those objects. The views you will see are of the moon Tricuspid which is the second moon of the planet Evath.

On its surface the Ketras are planning the destruction of Evath and are building a massive energy weapon called the zephyr one. This massive machine of destruction is powered by a line of Energy Collection Devices (ECD's). Your mission is to knock out the Zephyr one and your only chance of that is to destroy the ECD's that feed it with power.

As the game begins you are dropped on the light side but your quest lies on the dark side of the moon. There you will find ECD's and the Zephyr one that are guarded by Plexor tanks that automatically open fire when you come into range. Some regions that you will need to go are restricted and can only be reached through telepod towers but you will need to find telepod crystals to operate them.

First on your agenda must be to find shield plates for more protection and fuel rods to power your jetpac that can get you in and out of so much trouble.

The Freescape system almost gives you the feeling that you're there as you can fly over, around and into buildings and objects scattered around the planets surface. Inside the buildings you will find puzzles to solve and hidden trapdoors but the main puzzle will be how to knock out the ECD's. Although all you have to do is blast away its crystal at the top of the tower but unfortunately if the ECD you've knocked out is connected to more than one other, and most are, it simply regenerates. Therefore, you must scout out the moon carefully to find the ends of the line.

However, time is also against you as the Zephyr one is already building up its power bringing the destruction of Evath closer and also making it more difficult for you to destroy.

The view of the planet is seen through the helmet of you the Evath agent which is dominated by the Freescape 3D view of the moon's surface but below that are instruments that show the co-ordinates of your current location, the sector you are in, a compass, and current shield and fuel levels.

Once you've played your first game of Dark Side, Evath will have been destroyed and you in the vain attempt to save it but you will be convinced of two things. Firstly, it often takes a couple of games for a new system such as Freescape to settle down since it is only then that the development team concentrate on the plot and that Dark Side is one of those rare games that is both pretty to look at and a challenge to play.

T.H.

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The President is Missing



The President is Missing not only launches an intriguing detective style investigation but also a new style in games from US software house Cosmi. Cosmi made the news a few weeks ago with its move from the US Gold stable when it signed a UK joint venture with Microprose which was also once imported by US Gold.

With the move it has left behind its old, less than subtle style of game, that included the blood and guts of Forbidden Forest and Aztec Challenge and the taste shown in games like Chenobyl. The President is Missing is a high quality investigation backed up with two double sided disks, an audio tape and booklets and documents to set the scene.

The President, and incidently nine other western leaders, were supposed to be at a summit in Switzerland but the venue was switched at the last moment to somewhere in Lichtenstein. Last night two army helicopters carrying armed terrorists stormed the meeting place and abducted the leaders. Because of the grave crisis the Vice President has appointed you as Special Investigator making it your job to find out who perpetrated the abduction, bring them to justice and bring about the safe return of the leaders.

To help you in this onerous task you have access to the federal databases, agency reports, government documents, public and private records, intelligence files and a team of eight field agents. These files are stored on the four disk sides, but there is just so much information available that you must approach the case logically or get drowned in a sea of data.

A reasonable place to start is the official report of the kidnapping but more tempting is the audio tape included in the game box. This is packed with potential clues as well as a fair helping of red herrings, and includes recordings of phone taps, a speech made at Oxford University several years earlier, ransom demands from the kidnappers and statements from the President and the French Premier. This piles on the atmosphere and sets you scribbling frantic notes about names and places that crop up and some intriguing morse code that appears at the end of the tape that was intercepted by your intelligence services that is guaranteed to send you racing for the encyclopedia to find out its meaning.

On side three of the disk there are ten photo files to send the investigating buds as you scour the images with the zoom option to look for the vital clue. Almost at once you're beginning to get suspicious.

The kidnappers claim to be Islamic fundamentalists and demand among other things the destruction of the state of Israel, the withdrawal of western influences and puppet governments and the return of all Islamic assets. The voice of one of the kidnappers sounds similar to the speaker at Oxford who describes terrorists as heroes and freedom fighters. However, the meeting place was only disclosed to security agents and the leaders themselves hours before (they had only be warned of it being within 50 miles of Zurich) which suggests at least some inside knowledge and perhaps a traitor. Add to that the use of the abductors of Russian made gas bombs and a Russian trawler within range of where the abductors drop out of radar surveillance and you have the scope for some interesting theories.

However, theories on their own won't win the game and so you need to delve deeper into personal and private files and put your field agents to work. These can take any orders, go anywhere in the world and report back to you but the skill is deciding where to send them and ensuring their orders are clear enough to avoid time wasting and wild goose chasers.

The President is Missing is a fascinating game of international intrigue and although reminds you of the first part of the Fourth Protocol game the depth and attention to detail put it in a class of its own.

If solving the game isn't enough to satisfy your curiosity, and this should take several weeks of sleepless nights, then you can take up Cosmi's offer to send in your conclusions and evidence to help prosecute the offenders in return for the juries decisions.

T.H.

Touchline

Title: *The President is Missing.* ***Supplier:*** *Cosmi (Microprose), 2 Market Place, Tetbury, Gloucs., GL8 8DA.* ***Tel:*** *0666 54326.* ***Machine:*** *C64 disk.* ***Price:*** *£12.95.*

Sprite Library

It's back to the ABC in this month's delve into the Library

By Mike Benn

The alphabet takes on a shady appearance this month. The individual characters are based on a single sprite definition. Use the table to decide which characters you need; they are in alphabetical order so it should be easy to calculate which letter you will need. The C64 allows up to eight sprites on the screen at any one time which should meet most needs. If you require more sprites on the screen, I recommend *Split Sprite* by S.J. Chance (YC April 1987) which allows up to 32 sprites on the screen at one time.

Multialph — Multicolour

HEX	DECIMAL	DESCRIPTION
A0 — B9	160 — 185	CAPITALS
BA — C3	186 — 195	NUMBERS
C4 — DD	196 — 221	SMALL LETTERS
DE	222	CIRCLE
DF	223	SQUARE

Getting it all in

Type the basic loader as published and SAVE IT-DON'T RUN IT or it will self-destruct and, possibly, burst into flames. Before running the loader program you will need to reset the computer and type directly the following:

POKE43,0: POKE44,64: POKE16384,0:

NEW

and press return. This will trick the computer into believing that the basic now starts at $4000 instead of $0801. Load in the basic loader and run it;if error free, the program will automatically save as a block of data.

If you reload that data in the future remember to add a 1 after the device number. The data is saved in the following location $2800-$37FF.

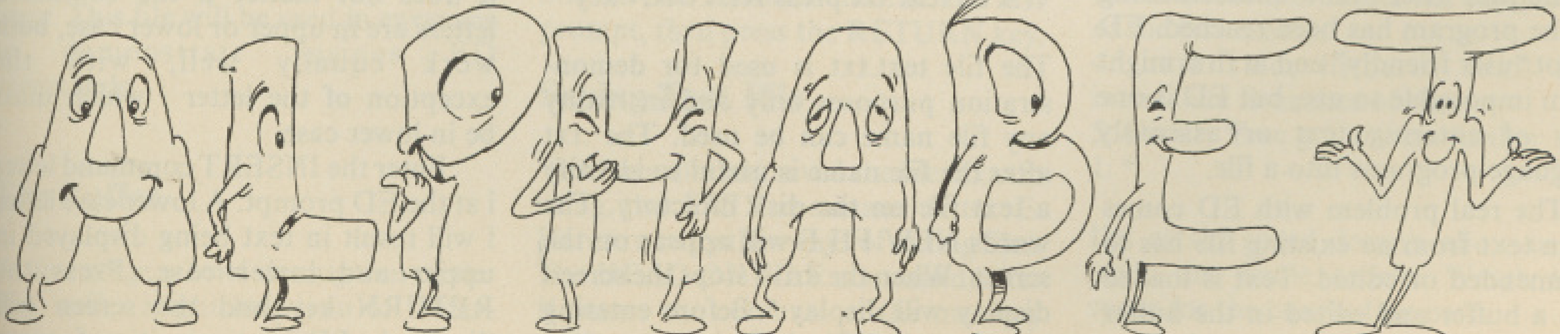
The sprites run from 160 to 223 in a compromise to avoid the area $2000 traditionally set aside for redefined character graphics and to avoid the need of typing in line after line of data.

If only one or two sprites are required then use this formula: (Sprite block No. — 160) *40 + 190 = the data line number at which that sprite blocks data starts. Remember to type in the following three lines of data and alter the variable BL to the number of data lines you have in your finished program, less 1.

The small basic program M. ALPH DISPLAY will variously animate the sprites in both non-expanded and expanded forms on the screen simultaneously. To hold on any sprite enter the same number for Start and End.

Any sprite Editor program will enable you to change and adapt the individual sprites to your own requirements. YC

See listings on page 61



CP/M+

The mysteries of the CP/M+ context editor explained
By Alan J. Wills

A few years ago I upgraded my trusty Commodore 64 for a new Commodore 128D. I was persuaded by slick advertising that I would be receiving three computers in one package. What really clinched the deal was the prospect of using CP/M+. I had worked with Wordstar, which runs under CP/M, and was excited by the prospect of using CP/M+ to run business programs from public domain software suppliers.

When my 128D arrived I immediately tried the CP/M+ system disk supplied with the computer. I was not impressed with the screen display and wondered how I could make use of my new operating system.

I soon found out that CP/M had many different formats and I would not be able to readily obtain programs from software suppliers. Indeed it became very obvious that I could do very little with CP/M+ unless I was prepared to study and work on practical exercises. The section on CP/M+ in the Commodore 128 handbook gave an inkling of what to expect, but no real guidance.

Recently I saw a series of articles on CP/M+ and the 128 in *Your Commodore*. I obtained a handbook on CP/M+ and over a few months I managed to glean enough information to use several of the transient programs supplied on the CP/M+ system disk.

Commands for operating the transient program, ED, will be demonstrated and it must be emphasised that only the basic commands will be shown. It will be up to the individual to progress onto more advanced techniques after some understanding of the program has been reached. ED is not "user friendly" and at first might seem impossible to use, but ED is one way of entering text or assembly language programs into a file.

The real problem with ED comes when text from an existing file has to be amended or edited. Text is loaded into a buffer and edited in the buffer before being saved to disk in its new form. Unfortunately the cursor does not perform its usual role; instead a character pointer called CP, which is invisible, is used for positioning in the buffer. Think of the buffer as a graph with CP positioning across the top and line positioning down the left hand side. The text being the actual area where plotting takes place. However the CP must know where it is at all times, so it is important to set CP at the start of the buffer.

After using ED for some time its editing system will become familiar and although rather slow to use, with a great deal of counting necessary, it at least gives the user a method of entering text into a file without the added expense of a more advanced editor.

I have compiled a summary of ED commands used in this article and it would be useful to have them at hand for reference as the exercises are worked. To make sure that ED is on the CP/M+ disk enter DIR at the system prompt and check the directory for ED. If it is on the disk then remove the disk and switch off the computer.

Loading ED

The following instructions load ED into the computer memory from the system disk. Place the CP/M+ disk containing ED in the default drive then switch on the drive and the computer (only if 128D). The system disk will auto boot and stop with the CP/M+ system prompt A>. At the prompt enter the following:

>A ed text.txt press RETURN key

The file text.txt is used for demonstration purposes only and in reality any file name can be used. The .txt after the file name is useful to identify a text file on the disk directory. The words NEW FILE will appear on the screen. When the drive stops the screen display will display:* Before entering text into the file it is important to understand the operating modes of the Ed program.

Operational Modes

ED has two modes – COMMAND and INSERT. In COMMAND mode the prompt displayed on the screen display is :*. In this mode commands can be entered one at a time or if more than one command is required in a continuous line with one command following the other, spaces are not required. Commands can be edited before the RETURN key is pressed. Use the CRSR right and left key to position the cursor then the DEL key to go to erase the character.

If the letter i is entered at the prompt and RETURN key pressed ED enters the INSERT mode. In this mode ED inserts text directly into the memory buffer.

ED will generate a line number for reference followed by the prompt :.. Editing in this mode is carried out by moving the CP, which will be explained later. A complete line of text can be deleted by using the CURSOR DOWN key immediately above the £ key. Spaces can be inserted into the text, by using the SPACE BAR.

Entering Text on a File

The next step is to enter text into a disk file. WARNING – it is not an easy matter to correct mistakes after text has been entered into a file so it is worth checking the text before the RETURN key is pressed. At this stage it does not matter if the command letters are in upper or lower case, both work equally well, with the exception of the letter i which must be in lower case.

Enter the INSERT command letter i at the ED prompt. A lower case letter i will result in text being displayed in upper and lower case. Press the RETURN key and the screen will display l:; ED is now waiting for text

Context Editor

to be entered into the buffer. Enter the following lines of text and press RETURN at the end of each line.

My dear son James, the head of the family,
died on 2 September 1834.
Thus death, or rather the conqueror of the last enemy,
has said, hitherto shall the immediate Branches of the
Family Tree go, and no further.

When line 6 prompt is displayed enter CONTROL Z (CONTROL key & Z together) and press the RETURN key. The CONTROL Z sequence will not be displayed on the screen. The screen display should now look like this:

```
A>ed text.txt

NEW FILE

        :*i

1: My dear son James, the head of the family,
2: died on 2 September 1834.
3: Thus death, or rather the conqueror of the last enemy,
4: Hath said, hitherto shall the immediate Branches of the
5: Family Tree go, and no further.
6: CONTROL Z (not displayed)
```

The CONTROL Z sequence switches off line numbering and forces ED to enter the COMMAND mode. To save the file for future use, enter the EXIT command letter E at the prompt and press the RETURN key. ED will save the file text.txt and make a backup copy. This file will be used in exercises to demonstrate various ED commands.

The Buffer

At this stage a brief description of the text buffer might help you to understand its complexity. Text is entered directly into the memory buffer from the keyboard. The size of the buffer can be determined by the 0V command entered at the prompt followed by the RETURN key; the display on the screen will give free space/buffer size. When the command is executed the screen will display 38271/38491. The LINE NUMBER command letter N allows movement through the lines of text in the buffer and is executed by entering a line number at the prompt.

The line selected is displayed on the screen; unlike the LINE command L which only goes to the line number and requires a further command to display text. The B command sets the CP at the start of the buffer and -B puts the CP at the end of the buffer. ED then enters the COMMAND mode and displays the command prompt :*. Enter B0P at the prompt to display text from the start of the buffer. The letter B moves the CP to the start of the buffer and 0 (figure 0) followed by the letter P displays half the buffer to the screen. The B0P command will be used extensively in the coming exercises to set the CP at the start of the memory buffer and print the file.

Viewing an Existing File

Now let's view the file text.txt created earlier and saved to the disk using the EXIT command. Before any viewing takes place the file MUST be loaded into the buffer. To do this use the APPEND command letter A is be used. Decide on how much text you want to view at one time and enter one of the A commands at the ED prompt, then press the RETURN key.

Saving Text File

You have already saved the file text.txt using the EXIT command letter E. Here are two other ways of saving files. The HEAD OF FILE command letter H, saves the contents of the memory buffer without leaving ED and sets the CP at the start of the buffer. This allows re-editing without having to load ED again.

If you make a mess of the text file and want to return to the original file then use the ORIGINAL command letter O. This command will abandon all changes made to the text file and returns to the original file ready for re-editing, again without the ED session. The O command differs from the E and H commands as you are asked to confirm the validity of the command by the prompts O (Y/N). Enter Y or N and press the RETURN key and leave the computer and disk drive to do the rest.

Loading from an Existing File

Now to get down to the serious work of editing a text file. To re-call text previously entered into a file enter the following line at the system prompt:

>A ed text.txt   press RETURN key

ED will load the file text.txt ready for editing. Use the combined APPEND #A and PAGE 0P commands to display text on the screen from the buffer. The screen will display the following:

```
A >ed text.txt
    :* #A0P

1: My dear son James, the head of the family,
2: died on 2 September 1834.
3: Thus death, or rather the conqueror of the last enemy,
4: hath said, hitherto shall the immediate Branches of the
5: Family Tree go, and no further.
1: *
```

I'm afraid space doesn't allow us to print the whole article. Watch this space for the concluding part.

See listings on page 61

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128

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Interceptor

All forms of combat have become much more remote as technology has improved. The Roman soldier certainly knew when he had killed someone as his victim was impaled only eighteen inches in front of his face. By the time a squaddie had a rifle in his hand, he was taking pot shots at people over half a mile away. If that person disappeared, the squaddie never knew whether he had hit his target or the man had just ducked down.

It is the same with air warfare. Gone are the days of the silk scarf, goggles and shouts of 'Tally-Ho Chaps' as you waved to your opponent before blasting him out of the skies. Now, all you get to see is a small blip on your radar screen at which let loose the odd missile or two. It is a bad show if you actually get to see your opponent.

Two of the latest killing machines are the F-16 Fighting Falcon and F/A-18 Hornet, pride of the American ground and naval forces respectively. Interceptor from Electronic Arts puts you in charge of either in their latest Amiga game.

As combat simulators go, Interceptor falls somewhere in the middle ground. You do not have to wade through



hundred page manuals before you discover how to take off. Nor is the documentation so sparse that you are literally flying on a wing and a prayer. Instead, there is a twenty four page manual, most of which is taken up with diagrams.

What the program does instead is to take you through a series of training flights. At the simplest of levels is free flight. There are no enemies or targets, just you alone in a big empty sky getting used to the controls of your aircraft.

The next stage is the easiest of all. You don't do anything as you sit beside your training officer as he demonstrates the seven basic combat manoeuvres – the aileron and barrel rolls, inside and vertical half loops, break turns, inverted flight and the split-S. You had better be paying attention though for your next task is to demonstrate that you can perform the moves yourself.

A qualification mission follows. Take off from the deck of the carrier, fly around dealing with any enemy aircraft that happen to be in the vicinity before finding and landing on the carrier once more. Only a successful mission here results in you being passed fit for active duty.

The controls of your plane are reasonably straightforward with most of the keys used being sensibly arranged and easy to remember. e.g. R for range, T for target, M for map and so on. For once in games of this type, I found that the combination of joystick and keyboard easy to manage so that I could stay airborne long enough to be shot down rather than going into a power dive from thirty thousand feet as I struggled to find the right button to press! The head up display, which throws an image of all the vital information onto the canopy proved more than useful and saved forever having to look down at the instrument panel. Ironically, the control that gave me the most trouble was the security wheel, included in the package to stop piracy.

You have a variety of weapons available at your disposal – AMRAAM medium range missiles, Sidewinder short range missile and a close range cannon. Naturally, it would be unfair to expect your opponent to fight back armed only with a pea shooter so it is necessary to make use of chaff, flares and electronic counter measures in an attempt to divert the bad guy's missiles. The only problem with these is that they do tend to advertise your presence somewhat.

One of the most unusual features of Interceptor is the number of different views that you, the pilot can obtain. You can look out of your cockpit left or right, up or down and forwards or backwards. As if that wasn't enough, you can also get third person views of your aircraft, i.e. someone standing right next to you but outside the aircraft, again from the same bewildering set of angles. Why you should want to do this in actual combat, I haven't yet discovered, but you must admit, it does look impressive in the photographs!

Interceptor has got the balance just about right between complexity and gameplay and the game should provide many hours of entertainment to any would-be, latter-day Biggles. An excellent game. **G.R.H.**

Touchline:
Title: *Interceptor.* ***Machine:*** *Amiga.* ***Supplier:*** *Electronic Arts, 11-49 Station Road, Langley, Berks SL3 8YN.* ***Tel:*** *0753 49442.* ***Price:*** *£24.95.*

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COMMODORE 64, SPECTRUM

Jack in the Box!

A handy utility which can be used by Basic or machine code programmers

By S. Scott

The Box utility program provides four main functions to allow powerful handling of screens.

Firstly, a PRINT routine is provided. This is not necessary for machine code programmers as the kernal plot routine at $FFF0 can be used. To position the cursor from Basic enter:

SYS 52797,X,Y

X must be in the range 0-39 and Y in the range 0-24.

The second routine is called CONFIG. This is a special routine that will allow the user to set up the utilities as required. To call the CONFIG routine from Basic enter:

SYS 52480,A,B,C,D,E,F

A – Border colour
B – Screen colour
C – Ink colour
D – Input ink colour
E – Cursor colour
F – ASCii code of cursor e.g. ASC(".") or 39

Calling the Config routine in machine code is slightly more complex. The parameters A to F must be set up by placing the required values in the locations below. This is done using LDA and STA in machine code.

A –$D020 – this is the standard border colour
B –$D021 – screen colour
C –$0286 –cursor colour
D –$CF68 – input colour
E –$CF69 – cursor colour
F –$CF6A– the cursor type

To call the Config routine enter JSR $CD00.

Routine three is an input routine. The main advantage that this has over the standard Commodore input statement is that numeric input is masked. Only numbers are allowed in numeric input, letters and symbols are ignored.

The cursor type and colour are pre-set by the config routine (section 2). For basic users, the input routine is called by the following statement:

SYS 52814,TYPE,DIGITS

Type is a parameter. This shows the type of input. 1 is used for numeric and any other value for alpha.

Digits simply indicate the number of characters in the string. This must be in a range of 1 to 25.

NB: the input data is stored at location $CF40 or 53056 decimal. To read back the data the following code may be used:

For numeric values:

```
10 SYS 52814,1,10
20 A$=""
30 FOR L=0 TO 9
40 A$=A$+CHR$(PEEK(L+53056))
50 NEXT L
60 A=VAL(A$)
70 PRINT"NUMBER INPUT";A
```

For strings:

```
10 SYS 52814,0,10
20 A$=""
30 FOR L=0 TO 9
40 A$=A$+CHR$(PEEK(L+53056))
50 NEXT L
60 PRINT"STRING INPUT ";A$
```

For machine code programmers, ensure that config has been set up. Set the X register to the number of digits and set location $CF5E to the required value(0 or 1). Now call the routine at $CE57 with a JSR statement. The input data is returned in location $CF40 as above.

The final routine is called Box. It was created to allow multi-size rectangles to be drawn with ease and speed. The routine works by clearing the required area with spaces and drawing a box. The boxes give much enhancement to menus and the general display.

To draw a box in Basic, ensure the config routine has been called and then enter:

SYS 52517,A,B,C,D,E,F,G,H,

The parameters are:

A – the start X co-ordinate
B – finish X
C – start Y
D – finish Y
E and F – these values are used to specify additional lines. The lines are displayed horizontally, inline with the top and bottom lines. The values for E and F should fall between C and D.
G – this is the colour of the box in the range 0 – 15.
H – the parameter allows the boxes to be drawn in reverse(1) or not(any other value).

An example box might be:

SYS52517,10,30,5,14,7,12,1,1

Machine code programmers may use boxes by ensuring that config has been called and then setting the following locations to the required values:

A	$CF5F	–	Start X
B	$CF60	–	Finish X
C	$CF61	–	Start Y
D	$CF62	–	Finish Y
E	$CF63	–	Line 1
F	$CF64	–	Line 2
G	$CF65	–	Colour of box
H	X-register	–	Reverse flag

When the parameters have been set, execute the routine at $C057 with JSR $C057.

Program Notes

The box routine has been kept compact to allow maximum memory usage by the programmer. Therefore, parameters are not fully checked for valid entries and invalid or high values may cause corruption of your data!

To make the box program even easier to use, the following basic lines can be adopted:

```
100 F=F+1
110 IFF=1THENLOAD"BOX UTILS",
    8,1
120 PRINT"8"
130 CO=52480 : REM CONFIG
140 BO=52517 : REM BOX
150 AT=52797 : REM PRINT AT
160 IN=52814 : REM INPUT
               ROUTINE
```

See listings on page 61


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The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

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Please contact this address for prices and availability.

The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

These programs are available on disk.

Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

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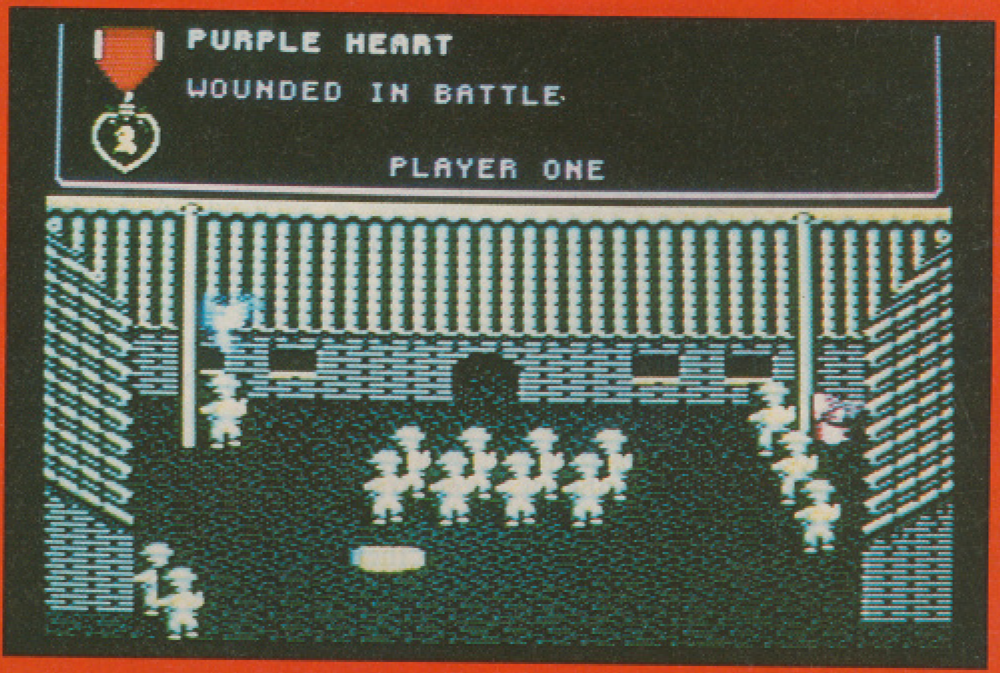
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FERNANDEZ MUST DIE





I honestly thought we'd left this kind of gratuitous violence safely behind us – obviously I was wrong (a hard thing for a journalist to admit)! Alright, Commando was good fun for a while, but it's been well and truly done to death (no pun intended). The scenario is totally predictable – fight your way up the screen shooting everything and everybody in your way to assasinate mad despotic General Fernandez and free the state of El Diablo from his tyrannical rein.

Fernandez Must Die was written by none other than the legendary Tony 'Ratt' Crowther and David 'Bish' Bishop – obviously on the train on their way to the publishers! If you read this Tony, I hope you're ashamed of yourself!

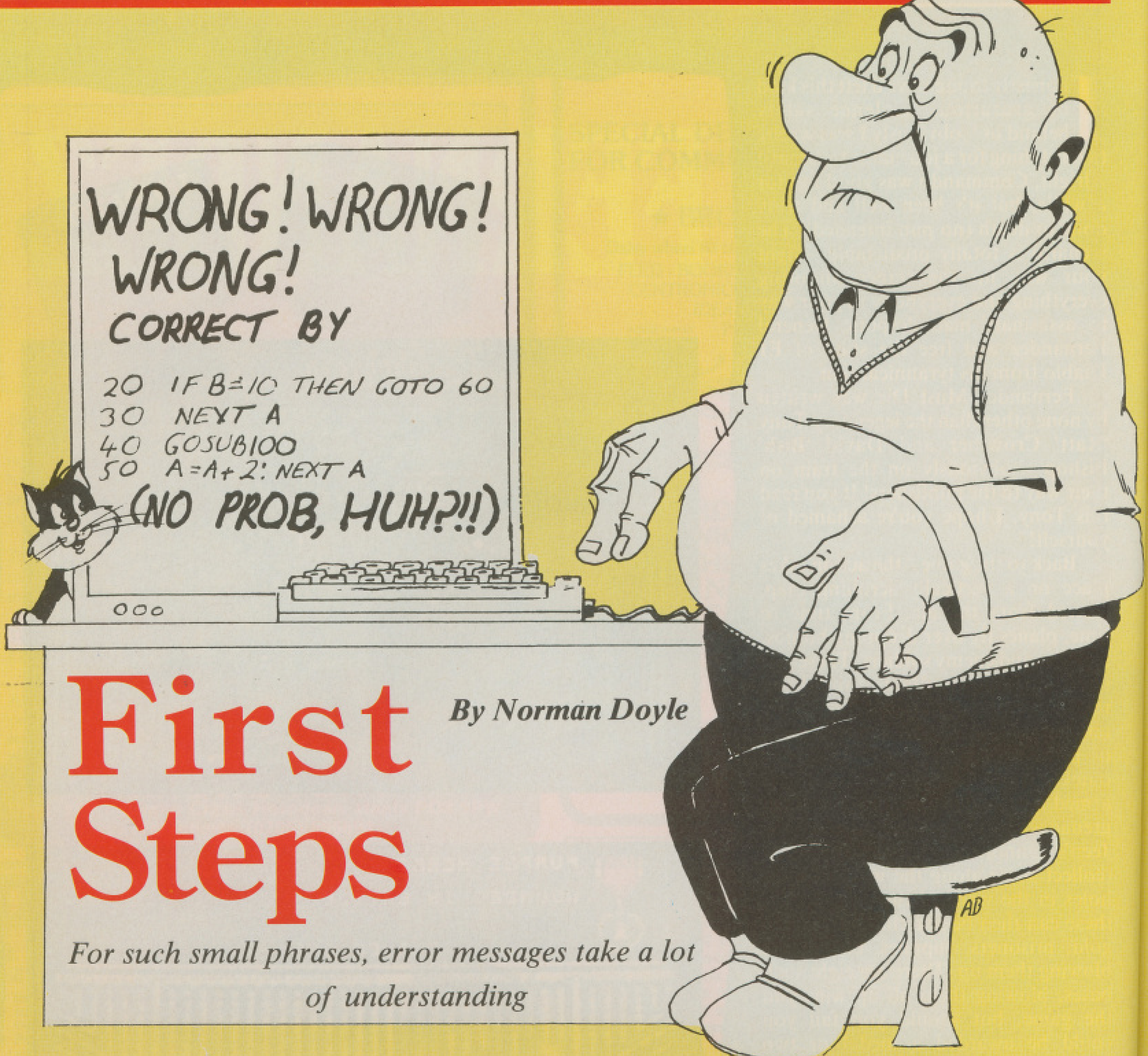
Back to the game – the action takes place on a vertically scrolling map, viewed from the air. From time to time, planes fly over dropping bombs, supplies and enemy soldiers. These you should avoid, collect and shoot respectively. Abandoned jeeps are abound, affording you a small measure of protection as well as getting you quickly from A to B. Your soldier is armed with a machine gun and hand grenades, and can make use of the Jeep's cannon if you have any shells (collect some along the way) to blow holes in the walls of the compounds, these can then be searched for hidden gold, prisoners, supplies, etc; before blowing them up. There are eight such bases, blowing them all up wins you the game, but should you fail you could be awarded a medal or two (posthumously).

The music is not brilliant, not even tolerable – 'sufferable' might come closer. Sound effects during the game are the predictable bangs and crashes, nothing particularly noteworthy.

This has been a dificult review to write, having absolutley nothing good to say about it. At the same time, some of you are going to buy this game no matter what I think. So if you like mindless violence, Fernandez Must Die is the game for you.

F.R.

Touchline:
***Product:** Fernandez Must Die **Suplier:** Image Works, Headway House, 66-73 Shoe Lane, London EC4P 4AP. **Price:** £9.99 (tape), £12.99 (disk) **Machine:** C64/128.*



First Steps

By Norman Doyle

For such small phrases, error messages take a lot of understanding

Error messages are actually devised to help rather than hinder progress. This article completes our look at file problems and tackles the errors that can arise with calculations.

NOT INPUT FILE

Occurrence: program error

Generated after an INPUT # or GET # command, this means that the file number refers to an output file. In other words the file was opened as a write only file.

NOT OUTPUT FILE

Occurrence: program error

Similar to the previous error, this appears when the wrong type of file is accessed by the PRINT command. The only solution for both of these problems is to first of all check that the command does describe the required action and that the file number is correct. If everything checks out, then the file must be closed and re-opened as the correct type.

FILE DATA

Occurrence: program/file error

When numeric data is expected from a file read command but string data is returned instead, this is the error message that appears. First of all check that the file is the right one and then alter the INPUT# or GET# command structure to handle the data correctly.

For some obscure reason, the C64 manual refers to this as the BAD DATA error message.

MISSING FILE NAME

Occurrence: user error

This only occurs when operating with a device number greater than three and is generated when a null string is given as the filename. This can only be done by using the syntax: LOAD " ",8. On cassette this would be a valid filename and would load the first program file encountered. The equivalent disk command is an asterisk or a colon followed by an asterisk.

ILLEGAL DEVICE NUMBER

Occurrence: user error

There are only two device numbers which cause this error: zero and three. These correspond to the screen and the

keyboard which cannot be saved to or loaded from. With sequential files the operating system is blind to device numbers and will apparently accept any syntaxially correct statement regardless.

Printers are not input devices but the operating system will still allow an attempt to load. Trying to save to a printer produces interesting results!

Legal device numbers range from zero to 255 but values less than 63, or between 128 and 191 generate a DEVICE NOT PRESENT error if the device is not connected. An attempt to access devices with any of the remaining values will be executed whether the device exists or not.

If a device number of 256 is used the error generated is ILLEGAL QUANTITY.

LOAD

Occurrence: operating system or user intervention

This indicates that a load has failed. The causes can be a faulty disk or tape, a permanent or temporary electrical fault or the pressing of the RUN/STOP key to abort a load.

The electrical fault may be as simple as a bad connection at the cassette port or a transient power spike. Spikes are caused by heavy load equipment such as central heating systems, cookers or fridges causing a feedback into the main. This usually causes the visual display to jump and a loud click is heard through the speaker.

Another cause can be misaligned tape heads. As time goes by, the playback/record head can move slightly and the tape signal misses the read head slightly. This results in a loss of 'volume' which the computer can only tolerate to a certain degree. Once the signal becomes so quiet that this threshold is reached, the tape may start reading until natural tape movement pulls the signal down below the cassette recorders threshold of 'hearing'.

Alternatively, the drive band in the cassette may be worn out. This causes the tape to vary in speed ruining the precise signal timing that the computer relies on to make sense of the data. Similarly, a motor fault would produce the same effect.

The solution to spikey mains signals is to unplug the offending equipment or to fit a smoothing mains filter socket for the computer equipment.

Alignment problems can be cured by a datasette doctor system which will help to diagnose and possibly correct the fault.

Disk faults result from similar causes to cassette faults but correction of alignment or speed problems is more difficult to solve. Disk drive alignment kits are available but they're more difficult to use. Given that the disk is faulty anyway, one may be worth a try. Care must be taken however because the drive plugs directly into the mains and a 240V shock could be at the least painful, at worst fatal.

VERIFY

Occurrence: operating system or user intervention

A verify error usually occurs because the disk or tape program is not the same as the one in the computer's memory. If this is definitely not the case, the device has one of the faults outlined under LOAD errors.

This completes the catalogue of cassette based errors but there are plenty of problems which can be experienced with disk drives. The C128, C16 and Plus/4 computers all have special handling systems to report these faults but C64 users will have to rely on the flashing red LED warning light on the drive. A cartridge or a disk operating system, such as the one supplied on the TEST/DEMO disk, can correct this problem.

All of the remaining errors in the C64's repertoire are programming errors. The specialised C128, C16 and Plus 4 errors will be covered in a later article.

Mathematical Errors

Mathematical operations follow very strict rules; all of which cannot be detected by the operating system. Use of statements such as 4*5+1 are valid when the required answer is 21 but invalid when the programmer means that four is to be multiplied by the result of five plus one. This should be correctly written as 4*(5+1). Such undetectable programmer errors are not the concern of the computer's operating system and care in the use of brackets is an essential skill to master.

ILLEGAL QUANTITY

This occurs when a number is used which goes beyond the allowable range for an integer variable or exceeds the 255 range of file numbers, device numbers and other such values.

The allowable range for integers is —32768 to +32767 inclusive. If a calculation is expected to exceed these limits it is best to use the more usual floating point method (A rather than A%).

OVERFLOW

An overflow error only occurs when the result of a floating point calculation exceeds plus or minus 1.70141183345E+38.

No errors are generated with negative exponential (E) values which exceed 2.93873588E-39. This is because lower decimal values represented in this way are very small indeed, having 38 zeros between the decimal point and the string of numbers preceeding the E value. Unfortunately, exceeding this value results in the variable becoming zero, so calculations should be kept well within the limit to ensure maximum accuracy.

DIVISION BY ZERO

Although dividing by zero is not permitted, dividing zero by another number is allowed but gives a value of zero.

FORMULA TOO COMPLEX

This can occur under numerous circumstances but basically means that the computer cannot cope with the mathematical formula as it is presented.

Correction involves breaking the calculation down into easily assimilated sub—calculations or to use fewer brackets if at all possible.

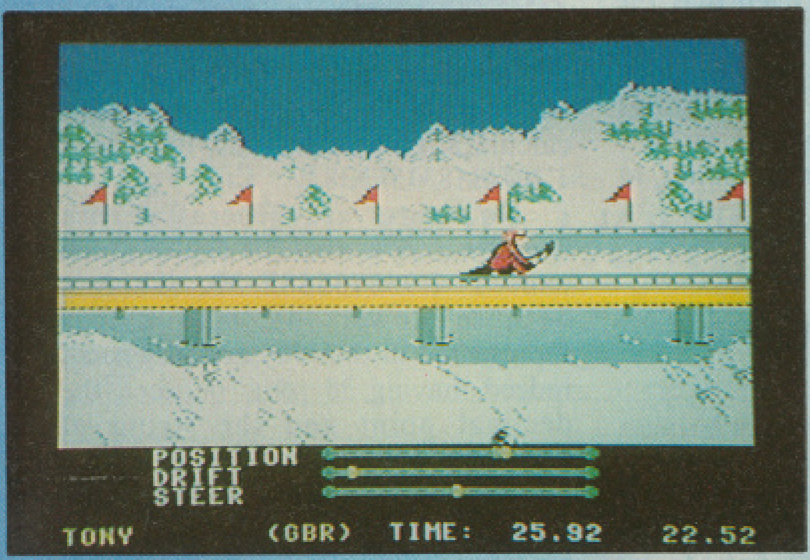
UNDEF'D FUNCTION

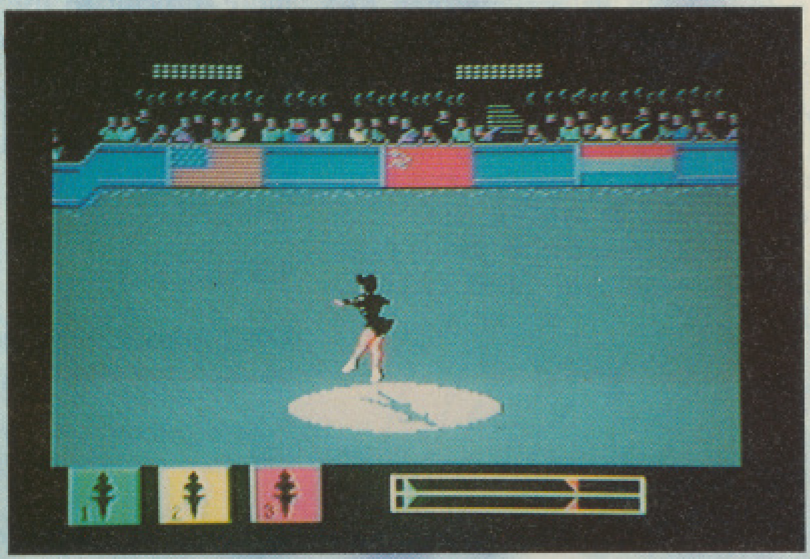
All FN functions must be defined before they are used. This may sound like commonsense but it can be easily done when a program is created in modular form using subroutines.

The way to avoid the error is to define all functions within the first few lines of every program. If a function is necessary at line 1000 of a program, go back and add a line as near to the beginning as possible to set up the FN formula.

Next month we'll be covering errors associated with GET and INPUT, including problems posed by mixing strings and numerical data. YC

The Games – Winter Edition





First there was Summer Games, then its sequel Summer Games II which were quickly followed by Winter, World and California Games. Now just when you thought it was safe to pick up your joystick out comes The Games – Winter Edition.

Seven more events await joystick athletes in the first of the many games set to jump on the Olympic bandwagon but why is the Winter Edition released now in the Summer when you just know there's a Summer Edition coming in the winter?

These new "games" games are as a result of Epyx's success in capturing the Olympic licence and the Winter Edition includes a combination of snow, skis, skates and ice which will prove irresitable to those aspiring to the greatness of top athletes such as Eddie "the Eagle" Edwards.

Many of the seven events in the Winter Edition appeared in Winter Games but are now more involved games demanding more than a sequence of joystick moves.

As with the previous games, up to eight players can compete for gold, silver and bronze medals and to set new world records. You can also practise any event or compete in one or more.

The luge is the first event and hurling yourself down a track on a small piece of wood seems the ideal way to end the contest, not start it. But you must steer your luge down one of four packed snow tracks faster than anyone else by steering it down the middle of straights and riding corners as much as you can without clipping the edges which will cost you valuable seconds.

Cross Country skiing also gives you a choice of courses that range from one to five kilometres and is basically the Winter Games Biathlon without the shooting and is the most disappointing of all events as a simple left. Right rhythm will ensure a good time.

The ice skating is far more involved than its Winter games equivalents as now you must choose your music and plan your program of moves before performing it in the Olympic arena. A selection of jazz, rock and pop ensure a mixture of beats to plan your double axels, spins and falls to. Then in the performance you have to perform the right move at the right time in the music to score maximum points.

For true Eddie Edwards action you should try the Ski Jump with its new jumper perspective of the slide down the slope before you hopefully soar into the air for a medal leaping jump or plummet and land in a heap in the snow.

The slalom course is just as treacherous as you must ski between the flags. Timing is vital but the inconsistent spacing of the flags means a simple rhythm just won't work.

Speed skating seems like an obvious event to include and many were surprised that it was left out of the original Winter Games but now it's back for those who want head to head racing action. In this event beating a computer pacer isn't quite as satisfying as crossing the finishing line while your human opponent is face down in the ice.

The final event is for the extroverts of the skiing world as TV cameras line the route of the downhill. The course is mapped out with flags that you must steer between to stay on your skis but when you come in range of the cameras you can show off with a few flips and jumps. Naturally, it's the one with the fastest time that will take the gold but it helps to get the crowd on your side.

The medals are presented to the winners in true Olympic fashion with the first three on pedestals, the gold medal winners national anthem playing as the flags are unfurled.

More stirring stuff from Epyx.

Touchline: **T.H.**

Title: *The Games – the Winter Edition.* ***Supplier:*** *Epyx (US Gold), Units 2/3, Holford Way, Holford, Birmingham, B6 7AX.* ***Tel:*** *021-356 3388.* ***Machine:*** *C64.* ***Price:*** *£9.95.*

Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

```
PROGRAM: SYNTAX CHECKER

5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10    :LN=70    :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time. YC

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

Listings

SPRITE LIBRARY

```
PROGRAM: MULTIALPH DISPLAY
```

```
85  10 REM**********************
    ****
31  20 REM* SPRITE LIRBARY DISPL
    AY *
81  30 REM*        MULTIALPH
        *
CB  40 REM**********************
    ****
FF  50 POKE55,0:POKE56,40:X=X+1:
    IFX=1THENLOAD"MULTIALPH",8,1

E9  60 P0=70:P1=150:P2=118:P3=15
    0:P4=180:P5=150:P6=248:P7=15
    0:S=160:E=199:D=250
76  70 V=53248:PRINT"[CLR,WHITE,
    DOWN26,RIGHT9,RVSON]F7 TO ST
    OP ANIMATION"
84  80 POKEV+21,15:POKEV+23,10:P
    OKEV+28,15:POKEV+29,12:POKEV
    +32,3:POKEV+33,3
63  90 POKEV+37,0:POKEV+38,15:PO
    KEV+39,2:POKEV+40,2:POKEV+41
    ,2:POKEV+42,2:POKEV,P0
B7  100 POKEV+1,P1:POKEV+2,P2:PO
    KEV+3,P3:POKEV+4,P4:POKEV+5,
    P5:POKEV+6,P6:POKEV+7,P7
1A  110 INPUT"[HOME,DOWN]START S
    PRITE";S:INPUT"END SPRITE";E
    :INPUT"DELAY";D
13  120 FORSP=STOE:FORT=0TOD:NEX
    T:PRINT"[HOME]"TAB(23)"SPRIT
    E NO.=";SP:POKE2040,SP
67  130 POKE2041,SP:POKE2042,SP:
    POKE2043,SP:NEXT:GETK$:IFK$=
    "[F7]"THEN110
34  140 GOTO120
```

```
PROGRAM: MULTIALPH DATA
```

```
AF  10 REM**********************
    *
B1  20 REM*    SPRITE  LIRBARY
    *
30  30 REM*    ---------------
    *
6F  40 REM*  MULTIALPH SPRITES
    *
CE  50 REM*  BASIC DATA LOADER
    *
99  60 REM* SPRITES DESIGNED BY
    *
2E  70 REM*      MIKE BENN
    *
C5  80 REM**********************
    *
DD  90 BL=255  :LN=190  :SA=1024
    0
89  100 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15
4F  110 READ A:IF A>255THENPRINT
    "NUMBER TO LARGE";LN+(L*10):
    STOP
98  120 CX=CX+A:POKE SA+L*16+D,A
    :NEXT D
D9  130 READ A:IF A<>CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
37  140 NEXTL:POKE43,0:POKE44,40
    :POKE45,0:POKE46,56
05  150 SAVE"MULTIALPH",8,1:END
EF  160 REM*********************
    ***********
3B  170 REM TAPE USERS WILL NEED
     TO CHANGE          DEVICE N
    UMBER FROM 8 TO 1
FB  180 REM*********************
    ***********
4F  190 DATA 0,0,0,0,0,0,0,42,0,
    0,170,128,2,166,160,6,674
6C  200 DATA 145,160,6,129,160,6
    ,129,160,6,129,160,6,170,160
    ,6,170,1702
AA  210 DATA 160,6,149,160,6,129
    ,160,6,129,160,6,129,160,6,1
    29,160,1655
A9  220 DATA 6,129,160,10,162,16
    8,26,166,168,21,69,80,0,0,0,
    190,1355
52  230 DATA 0,0,0,0,0,0,10,170,
    0,26,170,128,22,150,160,6,84
    2
62  240 DATA 129,160,6,129,160,6
    ,129,160,6,129,160,6,170,144
    ,6,170,1670
6B  250 DATA 64,6,149,128,6,129,
    160,6,129,160,6,129,160,6,12
    9,160,1527
8E  260 DATA 6,129,160,10,170,14
    4,26,170,64,21,85,0,0,0,0,25
    5,1240
C3  270 DATA 0,0,0,0,0,0,0,42,32
    ,0,170,96,2,166,160,6,674
09  280 DATA 145,160,6,129,160,6
    ,129,160,6,129,64,6,128,0,6,
    128,1362
AE  290 DATA 0,6,128,0,6,129,160
    ,6,129,160,6,129,160,6,129,1
    60,1314
A2  300 DATA 6,161,160,5,170,144
    ,1,106,64,0,85,0,0,0,0,144,1
    046
CF  310 DATA 0,0,0,0,0,0,10,170,
    0,26,170,128,22,150,160,6,84
    2
A8  320 DATA 129,160,6,129,160,6
    ,129,160,6,129,160,6,129,160
    ,6,129,1604
AY  330 DATA 160,6,129,160,6,129
    ,160,6,129,160,6,129,160,6,1
    29,160,1635
7D  340 DATA 6,129,160,10,170,14
    4,26,170,64,21,85,0,0,0,0,20
    7,1192
C1  350 DATA 0,0,0,0,0,0,10,170,
    160,26,170,160,22,149,160,6,
    1033
C8  360 DATA 129,160,6,129,64,6,
    128,0,6,128,0,6,170,128,6,17
    0,1236
BF  370 DATA 128,6,149,0,6,128,0
    ,6,128,0,6,128,0,6,128,160,9
    79
AD  380 DATA 6,129,160,10,170,16
    0,26,170,160,21,85,64,0,0,0,
    127,1288
D9  390 DATA 0,0,0,0,0,0,10,170,
    160,26,170,160,22,149,160,6,
    1033
D0  400 DATA 129,160,6,129,64,6,
    128,0,6,128,0,6,170,128,6,17
    0,1236
8B  410 DATA 128,6,149,0,6,128,0
    ,6,128,0,6,128,0,6,128,0,819

12  420 DATA 6,128,0,10,160,0,26
    ,160,0,21,64,0,0,0,0,127,702

E3  430 DATA 0,0,0,0,0,0,0,42,32
    ,0,170,96,2,166,160,6,674
63  440 DATA 145,160,6,129,160,6
    ,129,64,6,128,0,6,128,0,6,12
    8,1201
37  450 DATA 0,6,130,168,6,134,1
    68,6,133,160,6,129,160,6,129
    ,160,1501
4F  460 DATA 6,161,160,5,170,144
    ,1,106,64,0,85,0,0,0,0,2,904

93  470 DATA 0,0,0,0,0,0,10,162,
    168,26,166,168,22,133,160,6,
    1021
80  480 DATA 129,160,6,129,160,6
    ,129,160,6,129,160,6,170,160
    ,6,170,1686
F1  490 DATA 160,6,149,160,6,129
    ,160,6,129,160,6,129,160,6,1
    29,160,1655
E7  500 DATA 6,129,160,10,162,16
    8,26,166,168,21,69,80,0,0,0,
    95,1260
F5  510 DATA 0,0,0,0,0,0,0,42,12
    8,0,106,128,0,90,0,0,494
D7  520 DATA 26,0,0,26,0,0,26,0,
    0,26,0,0,26,0,0,26,156
4F  530 DATA 0,0,26,0,0,26,0,0,2
    6,0,0,26,0,0,26,0,130
DF  540 DATA 0,26,0,0,106,128,0,
    106,128,0,85,0,0,0,0,84,663
08  550 DATA 0,0,0,0,0,0,0,10,16
    0,0,26,160,0,22,128,0,506
99  560 DATA 6,128,0,6,128,0,6,1
    28,0,6,128,0,6,128,0,6,676
02  570 DATA 128,0,6,128,0,6,128
    ,0,6,128,0,6,128,10,6,128,80
    8
DD  580 DATA 26,6,128,22,170,128
    ,1,170,0,1,84,0,0,0,0,232,96
    8
```

```
99  590 DATA 0,0,0,0,0,0,10,160,
    160,26,162,160,22,130,160,6,
    996
6B  600 DATA 138,144,6,138,64,6,
    170,0,6,169,0,6,168,0,6,164,
    1185
95  610 DATA 0,6,168,0,6,170,0,6
    ,154,0,6,154,128,6,154,160,1
    118
15  620 DATA 6,150,160,10,166,16
    8,26,166,168,21,69,80,0,0,0,
    22,1212
F3  630 DATA 0,0,0,0,0,0,10,160,
    0,26,160,0,22,128,0,6,512
F1  640 DATA 128,0,6,128,0,6,128
    ,0,6,128,0,6,128,0,6,128,798
EA  650 DATA 0,6,128,0,6,128,0,6
    ,128,0,6,128,160,6,129,160,9
    91
35  660 DATA 6,129,160,10,170,16
    0,26,170,160,21,85,64,0,0,0,
    253,1414
2B  670 DATA 0,0,0,0,0,0,42,0,42
    ,106,128,170,90,128,168,26,9
    00
ED  680 DATA 162,168,26,162,168,
    26,106,104,26,106,104,26,88,
    104,26,24,1426
59  690 DATA 104,26,20,104,26,0,
    104,26,0,104,26,0,104,26,0,1
    04,774
D9  700 DATA 26,0,104,42,128,170
    ,106,129,170,85,1,85,0,0,0,4
    6,1092
83  710 DATA 0,0,0,0,0,0,42,2,16
    8,106,6,168,90,133,160,26,90
    1
EA  720 DATA 129,160,26,161,160,
    26,161,160,26,161,160,26,169
    ,160,26,105,1816
22  730 DATA 160,26,105,160,26,9
    0,160,26,26,160,26,26,160,26
    ,22,160,1359
66  740 DATA 26,6,160,42,5,160,1
    06,1,160,84,1,64,0,0,0,190,1
    005
E9  750 DATA 0,0,0,0,0,0,0,42,0,
    0,170,128,2,166,160,6,674
82  760 DATA 149,160,6,133,160,6
    ,129,160,6,129,160,6,129,160
    ,6,129,1628
CF  770 DATA 160,6,129,160,6,129
    ,160,6,129,160,6,129,160,6,1
    29,160,1635
FD  780 DATA 6,162,160,5,170,144
    ,1,106,64,0,85,0,0,0,0,72,97
    5
05  790 DATA 0,0,0,0,0,0,10,170,
    0,26,170,128,22,150,160,6,84
    2
F5  800 DATA 129,160,6,129,160,6
    ,129,160,6,129,160,6,170,144
    ,6,170,1670
E3  810 DATA 64,6,148,0,6,128,0,
    6,128,0,6,128,0,6,128,0,754
24  820 DATA 6,128,0,10,160,0,26
    ,160,0,21,64,0,0,0,0,122,697
24  830 DATA 0,0,0,0,0,0,0,42,0,
    0,170,128,2,166,160,6,674
9A  840 DATA 145,160,6,129,160,6
    ,129,160,6,129,160,6,129,160
    ,6,129,1620
5E  850 DATA 160,6,129,160,6,138
    ,160,6,154,160,6,154,160,6,1
    50,160,1715
89  860 DATA 6,166,160,5,170,168
    ,1,106,104,0,85,104,0,0,80,1
    58,1313
35  870 DATA 0,0,0,0,0,0,10,170,
    0,26,170,128,22,150,160,6,84
    2
25  880 DATA 129,160,6,129,160,6
    ,129,160,6,129,160,6,170,144
    ,6,170,1670
AB  890 DATA 64,6,168,0,6,170,0,
    6,154,128,6,150,128,6,134,12
    8,1254
5C  900 DATA 6,134,128,10,165,16
    0,26,161,160,21,65,64,0,0,0,
    193,1293
B1  910 DATA 0,0,0,0,0,0,0,42,32
    ,0,170,96,2,166,160,6,674
85  920 DATA 149,160,6,129,160,6
    ,129,160,6,129,64,5,160,0,1,
    104,1368
CD  930 DATA 0,0,90,0,0,22,128,0
    ,5,160,6,129,160,6,129,160,9
    95
B1  940 DATA 6,162,160,6,170,144
    ,6,106,64,5,85,0,0,0,0,151,1
    065
32  950 DATA 0,0,0,0,0,0,10,170,
    160,26,170,160,25,105,96,20,
    942
AE  960 DATA 104,64,0,104,0,0,10
    4,0,0,104,0,0,104,0,0,104,68
    8
90  970 DATA 0,0,104,0,0,104,0,0
    ,104,0,0,104,0,0,104,0,520
39  980 DATA 0,104,0,1,170,0,1,1
    70,0,1,84,0,0,0,0,208,739
74  990 DATA 0,0,0,0,0,0,0,0,0,1
    0,162,168,26,166,168,22,722
4B  1000 DATA 133,160,6,129,160,
    6,129,160,6,129,160,6,129,16
    0,6,129,1608
DF  1010 DATA 160,6,129,160,6,12
    9,160,6,129,160,6,129,160,6,
    129,160,1635
BE  1020 DATA 6,162,160,5,170,14
    4,1,106,64,0,85,0,0,0,151,
    1054
31  1030 DATA 0,0,0,0,0,0,0,0,0,
    10,0,40,26,0,104,26,206
3D  1040 DATA 128,168,22,129,160
    ,6,129,160,5,129,128,1,162,1
    28,1,166,1622
A4  1050 DATA 128,1,166,128,1,16
    6,128,1,102,0,0,102,0,0,106,
    0,1029
E5  1060 DATA 0,106,0,0,106,0,0,
    88,0,0,16,0,0,0,0,149,465
01  1070 DATA 0,0,0,0,0,0,42,128
    ,170,106,129,170,90,1,104,26
    ,966
DD  1080 DATA 8,104,26,24,104,26
    ,42,104,26,106,104,26,106,10
    4,26,166,1102
EE  1090 DATA 168,26,166,168,26,
    133,168,26,129,168,26,129,16
    8,26,1,104,1632
E6  1100 DATA 26,0,104,26,0,88,2
    4,0,24,16,0,16,0,0,0,7,331
FE  1110 DATA 0,0,0,0,0,0,2,128,
    160,6,129,160,6,129,160,6,88
    6
B7  1120 DATA 166,128,5,166,128,
    1,166,128,1,106,0,0,106,0,0,
    106,1207
0B  1130 DATA 0,0,106,0,0,102,0,
    0,166,128,0,166,128,2,166,16
    0,1124
F3  1140 DATA 6,149,160,6,129,16
    0,6,129,160,5,1,64,0,0,0,52,
    1027
D9  1150 DATA 0,0,0,0,0,0,10,0,1
    60,26,130,160,26,134,160,22,
    828
E5  1160 DATA 134,128,6,134,128,
    6,134,128,6,134,128,5,134,0,
    1,134,1340
E7  1170 DATA 0,1,170,0,1,170,0,
    1,106,0,0,104,0,0,104,0,657
49  1180 DATA 0,104,0,0,104,0,0,
    104,0,0,80,0,0,0,0,192,584
D4  1190 DATA 0,0,0,0,0,0,2,170,
    160,6,170,160,6,149,160,6,99
    9
03  1200 DATA 129,160,5,1,160,0,
    1,160,0,2,128,0,10,0,0,40,79
    6
88  1210 DATA 0,0,160,0,2,128,0,
    6,128,0,6,128,0,6,128,160,85
    2
4A  1220 DATA 6,129,160,6,170,16
    0,6,170,160,5,85,64,0,0,0,18
    6,1307
B3  1230 DATA 0,0,0,0,0,0,0,42,0
    ,0,170,128,2,166,160,6,674
3C  1240 DATA 149,160,6,133,160,
    6,161,160,6,169,160,6,169,16
    0,6,154,1765
44  1250 DATA 160,6,154,160,6,15
    0,160,5,134,160,6,133,160,5,
    129,160,1690
49  1260 DATA 6,162,160,5,170,14
    4,1,106,64,0,85,0,0,0,0,9,91
    2
ED  1270 DATA 0,0,0,0,0,0,0,10,0
    ,0,42,0,0,106,0,0,158
0B  1280 DATA 106,0,0,90,0,0,26,
    0,0,26,0,0,26,0,0,26,300
86  1290 DATA 0,0,26,0,0,26,0,0,
    26,0,0,26,0,0,26,0,130
80  1300 DATA 0,42,128,0,106,128
    ,0,106,128,0,85,0,0,0,0,89,8
    12
37  1310 DATA 0,0,0,0,0,0,0,170,
    128,2,170,160,6,170,160,6,97
    2
E1  1320 DATA 161,160,6,129,160,
    5,1,160,0,2,160,0,10,160,0,4
    2,1156
27  1330 DATA 128,0,170,0,0,168,
    0,2,160,0,6,128,160,6,129,16
    0,1217
27  1340 DATA 6,170,160,6,170,16
    0,6,170,160,5,85,64,0,0,0,23
    4,1396
3F  1350 DATA 0,0,0,0,0,0,2,170,
    160,6,170,160,6,150,160,6,99
    0
9C  1360 DATA 130,128,5,74,128,0
    ,10,0,0,42,0,0,170,128,1,170
    ,986
CA  1370 DATA 128,1,86,160,0,1,1
    60,0,1,160,2,129,160,6,130,1
    60,1284
56  1380 DATA 6,170,128,5,170,12
    8,1,106,0,0,85,0,0,0,0,252,1
    051
78  1390 DATA 0,0,0,0,0,0,0,10,1
    28,0,26,128,0,42,128,0,462
78  1400 DATA 106,128,0,170,128,
    1,166,128,1,166,128,2,166,12
    8,6,150,1574
93  1410 DATA 128,6,134,128,10,1
    70,168,26,170,168,26,170,168
    ,21,86,144,1723
C7  1420 DATA 0,10,160,0,26,160,
    0,26,160,0,21,64,0,0,0,169,7
    96
BD  1430 DATA 0,0,0,0,0,0,2,170,
    160,6,170,160,6,170,160,6,10
    10
34  1440 DATA 149,160,6,129,160,
    6,129,64,6,168,0,5,170,0,1,9
    0,1243
7E  1450 DATA 128,0,22,160,0,5,1
    60,0,1,160,6,129,160,6,130,1
    60,1227
21  1460 DATA 6,170,160,5,170,12
    8,1,106,0,0,85,0,0,0,0,19,85
    0
AE  1470 DATA 0,0,0,0,0,0,0,42,0
    ,0,170,128,2,166,160,6,674
```

```
75 1480 DATA 145,160,6,129,160,6,129,64,6,128,0,6,170,0,6,170,1285
42 1490 DATA 128,6,150,160,6,129,160,6,129,160,6,129,160,6,162,160,1657
63 1500 DATA 6,170,160,5,170,128,1,106,0,0,85,0,0,0,0,109,940
8D 1510 DATA 0,0,0,0,0,0,2,170,160,6,170,160,6,170,160,6,1010
9C 1520 DATA 149,160,6,129,160,5,74,160,0,26,0,0,26,0,0,40,935
5A 1530 DATA 0,0,104,0,0,104,0,0,160,0,1,160,0,1,160,0,690
E8 1540 DATA 2,168,0,6,168,0,6,168,0,5,80,0,0,0,0,98,701
6D 1550 DATA 0,0,0,0,0,0,0,42,0,0,170,128,2,166,160,6,674
3D 1560 DATA 149,160,6,133,160,6,129,160,6,162,160,5,170,128,1,106,1641
A2 1570 DATA 0,0,166,128,2,149,128,2,133,160,6,129,160,6,129,160,1458
42 1580 DATA 6,162,160,5,170,144,1,106,64,0,85,0,0,0,0,36,939
C8 1590 DATA 0,0,0,0,0,0,0,42,0,0,170,128,2,170,160,6,678
B1 1600 DATA 166,160,6,149,160,6,133,160,6,129,160,6,161,160,5,170,1737
B4 1610 DATA 160,1,106,160,0,85,160,0,0,160,2,128,160,6,128,160,1416
96 1620 DATA 6,162,160,5,170,128,1,106,0,0,85,0,0,0,0,251,1074
5E 1630 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,168,0,2,170
DF 1640 DATA 170,0,10,90,128,26,22,128,20,6,128,0,166,128,2,170,1194
2D 1650 DATA 128,10,170,128,26,154,128,26,90,128,26,22,128,26,6,128,1324
79 1660 DATA 26,138,128,22,170,160,5,170,160,1,85,64,0,0,0,144,1273
5F 1670 DATA 0,0,0,0,0,0,10,160,0,26,160,0,22,128,0,6,512
DC 1680 DATA 128,0,6,128,0,6,128,0,6,128,0,6,138,0,6,170,850
BF 1690 DATA 128,6,166,160,6,149,160,6,129,160,6,129,160,6,129,160,1660
92 1700 DATA 6,162,160,10,170,128,26,154,0,21,69,0,0,0,0,20,926
73 1710 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,32,0,32
DD 1720 DATA 42,96,0,170,160,2,166,160,6,149,160,6,133,160,6,129,1545
A2 1730 DATA 64,6,128,0,6,128,0,6,128,0,6,128,160,6,129,160,1055
1A 1740 DATA 6,162,160,5,170,144,1,106,64,0,85,0,0,0,0,139,1042
FC 1750 DATA 0,0,0,0,0,0,0,10,160,0,26,160,0,22,128,0,506
3C 1760 DATA 6,128,0,6,128,0,6,128,0,6,128,0,166,128,2,170,1002
5C 1770 DATA 128,10,154,128,26,86,128,26,86,128,26,6,128,26,10,128,1224
D7 1780 DATA 26.138,128,22,170,160,5,166,160,1,81,64,0,0,0,20,1141
9B 1790 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,42,0,0,42
24 1800 DATA 170,128,2,166,160,6,149,160,6,133,160,6,161,160,6,162,1735
C9 1810 DATA 160,6,170,160,6,170,128,6,154,0,6,148,0,6,128,160,1408
BE 1820 DATA 6,160,160,5,170,128,1,106,0,0,84,0,0,0,0,0,820
4D 1830 DATA 0,0,0,0,0,0,0,10,128,0,42,160,0,165,160,1,666
40 1840 DATA 161,64,1,160,0,1,160,0,1,160,0,1,160,0,2,170,1041
0E 1850 DATA 0,6,170,0,5,164,0,1,160,0,1,160,0,1,160,0,828
DA 1860 DATA 1,160,0,2,168,0,6,168,0,5,80,0,0,0,0,195,785
B4 1870 DATA 0,0,0,0,0,0,0,0,0,0,42,0,0,170,128,2,342
35 1880 DATA 166,160,2,149,160,6,133,160,6,129,160,6,130,160,6,162,1695
EB 1890 DATA 160,6,170,160,5,170,160,1,105,160,0,85,160,2,133,160,1637
BA 1900 DATA 6,150,160,5,170,128,1,106,0,0,84,0,0,0,0,0,810
14 1910 DATA 0,0,0,0,0,0,10,160,0,26,160,0,22,128,0,6,512
4B 1920 DATA 128,0,6,128,0,6,128,0,6,128,0,6,138,0,6,170,850
5B 1930 DATA 128,6,166,160,6,149,160,6,133,160,6,129,160,6,129,160,1664
9A 1940 DATA 6,129,160,10,162,168,26,166,168,21,85,80,0,0,0,245,1426
24 1950 DATA 0,0,0,0,0,0,0,10,0,0,26,0,0,20,0,0,56
35 1960 DATA 0,0,0,42,0,0,106,0,0,90,0,0,26,0,0,26,290
7C 1970 DATA 0,0,26,0,0,26,0,0,26,0,0,26,0,0,26,0,130
2B 1980 DATA 0,26,0,0,42,128,0,106,128,0,85,64,0,0,0,168,747
D6 1990 DATA 0,0,160,0,1,160,0,1,64,0,0,0,0,2,160,0,548
90 2000 DATA 6,160,0,5,160,0,1,160,0,1,160,0,1,160,0,1,815
90 2010 DATA 160,0,1,160,0,1,160,2,129,160,6,129,160,6,130,160,1364
66 2020 DATA 6,170,128,5,170,0,1,104,0,0,84,0,0,0,0,93,761
BC 2030 DATA 0,0,0,0,0,0,10,160,0,26,160,0,22,128,0,6,512
58 2040 DATA 128,160,6,130,160,6,130,128,6,138,0,6,138,0,6,168,1310
83 2050 DATA 0,6,168,0,6,170,0,6,154,0,6,154,128,6,150,160,1114
58 2060 DATA 6,133,160,10,162,168,26,166,168,21,69,80,0,0,0,26,1195
E4 2070 DATA 0,0,0,0,0,0,0,42,0,0,106,0,0,90,0,0,238
3D 2080 DATA 26,0,0,26,0,0,26,0,0,26,0,0,26,0,0,26,156
F9 2090 DATA 0,0,26,0,0,26,0,0,26,0,0,26,0,0,26,0,130
AD 2100 DATA 0,26,0,0,106,128,0,106,128,0,85,0,0,0,0,131,710
95 2110 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
05 2120 DATA 0,0,0,0,0,10,128,0,26,128,0,22,138,32,6,170,660
49 2130 DATA 168,6,170,168,6,154,104,6,154,104,6,154,104,6,154,104,1568
D9 2140 DATA 6,154,104,10,154,106,26,154,106,21,21,84,0,0,0,251,1197
FD 2150 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
69 2160 DATA 0,0,0,0,0,0,0,0,2,160,0,6,162,128,5,170,633
28 2170 DATA 160,1,169,160,1,165,160,1,161,160,1,161,160,1,161,160,1782
5E 2180 DATA 1,161,160,2,161,168,6,161,168,5,65,80,0,0,0,192,1330
C5 2190 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
03 2200 DATA 0,0,0,0,0,0,42,0,0,170,128,2,166,160,6,149,823
19 2210 DATA 160,6,133,160,6,129,160,6,129,160,6,129,160,6,129,160,1639
91 2220 DATA 6,161,160,5,170,128,1,106,0,0,84,0,0,0,0,62,883
EB 2230 DATA 0,0,0,0,0,0,10,138,0,26,170,128,22,166,160,6,826
0A 2240 DATA 149,160,6,133,160,6,129,160,6,129,160,6,162,160,6,170,1702
5C 2250 DATA 128,6,154,0,6,149,0,6,128,0,6,128,0,6,128,0,845
3F 2260 DATA 6,128,0,10,160,0,26,160,0,21,64,0,0,0,0,2,577
44 2270 DATA 0,0,0,0,0,0,0,162,160,2,170,160,10,154,128,26,972
25 2280 DATA 86,128,26,22,128,26,6,128,26,6,128,26,138,128,22,170,1194
99 2290 DATA 128,5,166,128,1,86,128,0,6,128,0,6,128,0,6,128,1044
39 2300 DATA 0,6,128,0,10,160,0,26,160,0,21,64,0,0,0,195,770
5C 2310 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
84 2320 DATA 0,0,0,0,0,0,0,0,2,160,0,6,162,128,5,170,633
42 2330 DATA 160,1,169,160,1,165,160,1,161,64,1,160,0,1,160,0,1364
C7 2340 DATA 1,160,0,2,168,0,6,168,0,5,80,0,0,0,0,7,597
A4 2350 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
8E 2360 DATA 0,0,0,42,0,0,170,128,2,166,160,6,150,160,6,133,1123
10 2370 DATA 160,6,161,64,6,170,0,5,170,128,1,90,160,2,150,160,1433
99 2380 DATA 6,165,160,5,170,160,1,106,128,0,85,0,0,0,0,28,1014
C4 2390 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,40,0,0,40
4C 2400 DATA 104,0,0,104,0,0,170,0,1,170,0,1,104,0,0,104,758
72 2410 DATA 0,0,104,0,0,104,0,0,104,0,0,104,0,0,104,0,520
B8 2420 DATA 0,104,0,0,106,0,0,90,0,0,20,0,0,0,0,26,346
D4 2430 DATA 0,0,0,0,0,0,0,0,0,
```

```
    0,0,0,0,0,0,0,0
39  2440 DATA 0,0,0,0,0,0,0,0,10
    ,130,160,26,134,160,22,134,7
    76
30  2450 DATA 128,6,134,128,6,13
    4,128,6,134,128,6,134,128,6,
    138,128,1472
12  2460 DATA 6,170,128,5,170,16
    0,1,166,160,1,69,64,0,0,0,0,
    1100
3C  2470 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
B8  2480 DATA 0,0,0,0,0,0,0,0,10
    ,0,160,26,1,160,22,1,380
2B  2490 DATA 128,6,2,128,6,134,
    128,6,134,128,5,134,0,1,170,
    0,1110
D6  2500 DATA 1,170,0,1,104,0,0,
    104,0,0,80,0,0,0,0,2,462
04  2510 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
52  2520 DATA 0,0,0,0,0,0,0,0,42
    ,40,168,106,105,168,90,105,8
    24
FD  2530 DATA 160,26,105,160,26,
    105,160,26,105,160,26,105,16
    0,26,170,160,1680
2C  2540 DATA 26,170,160,22,105,
    128,4,81,0,0,0,0,0,0,0,696
6C  2550 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
6F  2560 DATA 0,0,0,0,0,10,2,128
    ,26,6,128,26,6,128,26,138,62
    4
AC  2570 DATA 128,22,154,0,5,168
    ,0,1,168,0,2,170,0,6,154,0,9
    78
0A  2580 DATA 6,154,128,10,22,12
    8,26,6,128,21,5,64,0,0,0,223
    ,921
A5  2590 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,10,162,168,26,366
DC  2600 DATA 166,168,22,133,160
    ,6,129,160,6,129,160,6,130,1
    60,6,162,1703
19  2610 DATA 160,6,170,160,5,17
    0,160,1,105,160,0,85,160,2,1
    28,160,1632
59  2620 DATA 6,130,160,5,170,12
    8,1,106,0,0,84,0,0,0,0,146,9
    36
83  2630 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
BF  2640 DATA 0,0,2,170,160,6,17
    0,160,6,166,160,6,149,160,6,
    133,1454
E9  2650 DATA 160,5,2,128,0,10,1
    28,0,42,0,0,168,0,2,160,160,
    965
5C  2660 DATA 6,130,160,6,170,16
    0,6,170,160,5,85,64,0,0,0,32
    ,1154
EB  2670 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
00  2680 DATA 0,0,0,10,0,0,42,12
    8,0,42,128,0,170,160,1,170,8
    51
2B  2690 DATA 160,1,170,160,1,17
    0,160,1,170,160,1,170,160,1,
    106,128,1719
37  2700 DATA 0,106,128,0,26,0,0
    ,21,0,0,0,0,0,0,0,101,382
33  2710 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
EF  2720 DATA 0,0,0,170,160,1,17
    0,160,1,170,160,1,170,160,1,
    170,1494
65  2730 DATA 160,1,170,160,1,17
    0,160,1,170,160,1,170,160,1,
    170,160,1815
BA  2740 DATA 1,170,160,1,170,16
    0,1,85,64,0,0,0,0,0,0,0,812
```

SAMPLER 64

Continued from last issue

PROGRAM: DATA 3

```
95  5 CH=0:L=9905
0B  10 POKE53280,0:POKE53281,0
5E  20 PRINT"[CLR]"
15  30 PRINT"DATA LOADER 3"
1A  40 PRINT"[HOME,DOWN2]POKE LO
    CATION:"L
61  50 FOR I=1 TO 8
9A  60 READ A
9A  65 IF A<0 THEN 120
F0  70 POKEL,A:CH=CH+A:L=L+1
D2  80 NEXT
4E  90 READ SUM
3D  100 IF SUM<>CHTHEN PRINT"CHE
    CKSUM ERROR IN LINE"PEEK(64)
    *256+PEEK(63):STOP
9A  110 CH=0:GOTO 40
F6  120 PRINT"READY TO SAVE PROG
    RAM"
E9  130 PRINT:PRINT"PRESS RETURN
    "
AE  140 GETA$:IFA$<>CHR$(13)THEN
    140
35  150 PRINT"[CLR]POKE 43,1:POK
    E44,8:POKE45,0:POKE46,54:SAV
    E"+CHR$(34);
92  160 PRINT"SAMPLER64"+CHR$(34
    )+",8"
4E  170 POKE631,19:POKE632,13:PO
    KE198,2
C6  500 DATA 0,0,0,0,0,0,0,0,0
A3  501 DATA 0,0,0,0,0,6,1,1,8
84  502 DATA 6,0,0,0,0,0,0,0,6
0B  503 DATA 0,0,0,0,0,0,0,0,0
0A  504 DATA 0,0,0,0,0,0,0,0,0
01  505 DATA 1,1,1,1,1,1,1,1,8
D9  506 DATA 1,1,1,1,0,6,1,1,12
1E  507 DATA 6,0,0,0,0,0,14,14,3
    4
AA  508 DATA 14,14,14,14,14,14,1
    4,14,112
B0  509 DATA 14,14,14,14,0,0,1,1
    ,58
44  510 DATA 1,1,1,1,1,1,1,1,8
3E  511 DATA 1,1,1,1,0,6,1,1,12
B1  512 DATA 6,0,0,0,0,0,0,0,6
70  513 DATA 0,0,0,0,0,0,0,0,0
B5  514 DATA 0,0,0,0,0,0,1,1,2
BE  515 DATA 1,1,1,1,1,1,1,1,8
CC  516 DATA 1,1,1,1,0,6,1,1,12
53  517 DATA 6,0,0,0,0,0,14,14,3
    4
39  518 DATA 14,14,14,14,14,14,1
    4,14,112
5B  519 DATA 14,14,14,14,0,0,1,1
    ,58
71  520 DATA 1,1,1,1,1,1,1,1,8
C9  521 DATA 1,1,1,1,0,6,1,1,12
7F  522 DATA 6,0,0,0,0,0,0,0,6
BE  523 DATA 0,0,0,0,0,0,0,0,0
BF  524 DATA 0,0,0,0,0,0,1,1,2
B4  525 DATA 1,1,1,1,1,1,1,1,8
AE  526 DATA 1,1,1,1,0,6,1,1,12
F9  527 DATA 6,0,0,0,0,0,14,14,3
    4
C3  528 DATA 14,14,14,14,14,14,1
    4,14,112
B8  529 DATA 14,14,0,0,0,0,0,0,2
    8
23  530 DATA 0,1,1,1,1,0,0,0,4
80  531 DATA 0,0,0,0,0,6,1,1,8
65  532 DATA 6,0,0,0,0,0,0,0,6
24  533 DATA 0,0,0,0,0,0,0,0,0
EB  534 DATA 0,0,0,0,0,0,0,0,0
EA  535 DATA 0,0,0,0,0,0,0,0,0
0F  536 DATA 0.0.0.0.0.6.1.1.8
A3  537 DATA 6,6,0,0,0,0,0,0,12
AF  538 DATA 0,0,0,0,0,0,0,0,0
AE  539 DATA 0,0,0,0,0,0,0,0,0
AD  540 DATA 0,0,0,0,0,0,0,0,0
9A  541 DATA 0,0,0,0,0,6,1,1,8
2F  542 DATA 6,6,6,6,6,6,6,6,48
2E  543 DATA 6,6,6,6,6,6,6,6,48
2D  544 DATA 6,6,6,6,6,6,6,6,48
2C  545 DATA 6,6,6,6,6,6,6,6,48
14  546 DATA 6,6,6,6,6,6,1,1,38
9E  547 DATA 1,1,1,1,1,1,1,1,8
9D  548 DATA 1,1,1,1,1,1,1,1,8
9C  549 DATA 1,1,1,1,1,1,1,1,8
D3  550 DATA 1,1,1,1,1,1,1,1,8
DC  551 DATA 1,1,1,1,1,1,1,0,7
D9  552 DATA 0,0,0,0,0,0,0,0,0
D8  553 DATA 0,0,0,0,0,0,0,0,0
9F  554 DATA 0,0,0,0,0,0,0,0,0
9E  555 DATA 0,0,0,0,0,0,0,0,0
9D  556 DATA 0,0,0,0,0,0,1,0,1
9C  557 DATA 0,0,0,0,0,0,0,0,0
C3  558 DATA 0,0,0,0,0,0,0,0,0
C2  559 DATA 0,0,0,0,0,0,0,0,0
C1  560 DATA 0,0,0,0,0,0,0,0,0
C0  561 DATA 0,0,0,0,0,0,0,0,0
07  562 DATA 0,0,0,0,0,0,0,0,0
06  563 DATA 0,0,0,0,0,0,0,0,0
05  564 DATA 0,0,0,0,0,0,0,0,0
04  565 DATA 0,0,0,0,0,0,0,0,0
4B  566 DATA 0,0,0,0,0,0,0,0,0
4A  567 DATA 0,0,0,0,0,0,0,0,0
49  568 DATA 0,0,0,0,0,0,0,0,0
34  569 DATA 0,0,0,0,0,0,0,169,1
    69
F8  570 DATA 5,133,1,120,169,11,
    141,17,597
7C  571 DATA 208,169,176,162,0,1
    41,6,220,1082
95  572 DATA 142,7,220,173,13,22
    0,169,25,969
F3  573 DATA 141,15,220,173,13,2
    20,41,16,839
3F  574 DATA 201,0,240,11,169,15
    ,141,24,801
A9  575 DATA 212,32,59,240,76,28
    ,240,169,1056
39  576 DATA 0,141,24,212,32,59,
    240,76,784
E5  577 DATA 28,240,160,0,145,25
    1,230,251,1305
79  578 DATA 208,8,230,252,165,2
    52,201,208,1524
C1  579 DATA 240,1,96,76,112,243
    ,0,169,937
25  580 DATA 0,133,251,169,12,13
    3,252,76,1026
64  581 DATA 0,240,0,0,0,0,0,120
    ,360
D6  582 DATA 169,11,141,17,208,1
    69,53,133,901
24  583 DATA 1,160,0,169,0,133,2
    51,169,883
F7  584 DATA 12,133,252,177,251,
    141,24,212,1202
B4  585 DATA 162,0,232,224,5,208
    ,251,200,1282
26  586 DATA 208,241,230,252,165
    ,252,201,208,1757
36  587 DATA 208,233,76,165,241,
    0,0,169,1092
75  588 DATA 1,133,65,76,80,240,
    165,65,825
05  589 DATA 201,1,208,3,76,96,2
    40,201,1026
1C  590 DATA 2,240,3,76,165,241,
    76,32,835
E8  591 DATA 241,0,0,0,0,0,0,169
    ,410
6B  592 DATA 0,133,251,169,12,13
    3,252,169,1119
B4  593 DATA 2,133,65,169,5,133,
    1,120,628
61  594 DATA 169,11,141,17,208,1
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     69,176,162,1053
C7   595 DATA 0,141,6,220,142,7,2
     20,173,909
1F   596 DATA 13,220,169,25,141,1
     5,220,160,963
9B   597 DATA 0,162,8,169,0,133,2
     ,24,498
30   598 DATA 173,13,220,41,16,24
     0,30,169,902
A6   599 DATA 15,141,24,212,56,38
     ,2,202,690
A0   600 DATA 208,237,165,2,145,2
     51,230,251,1489
3E   601 DATA 208,8,230,252,165,2
     52,201,208,1524
3A   602 DATA 240,11,76,216,240,1
     69,0,141,1093
D1   603 DATA 24,212,76,238,240,7
     6,112,243,1221
ED   604 DATA 0,0,0,0,0,0,0,0,0
30   605 DATA 0,0,0,0,0,0,0,120,1
     20
7E   606 DATA 169,11,141,17,208,1
     69,53,133,901
E0   607 DATA 1,169,0,133,251,169
     ,12,133,868
0E   608 DATA 252,160,0,177,251,1
     33,2,160,1135
DB   609 DATA 8,165,2,10,133,2,17
     6,29,525
BA   610 DATA 169,0,141,24,212,23
     4,234,234,1248
1B   611 DATA 234,136,208,237,230
     ,251,208,8,1512
CE   612 DATA 230,252,165,252,201
     ,208,240,15,1563
73   613 DATA 76,50,241,234,234,2
     34,234,169,1472
3C   614 DATA 15,141,24,212,76,70
     ,241,76,855
8D   615 DATA 165,241,0,0,0,0,0,1
     20,526
20   616 DATA 169,11,141,17,208,1
     69,53,133,901
D0   617 DATA 1,160,255,169,0,133
     ,251,169,1138
4A   618 DATA 207,133,252,177,251
     ,141,24,212,1397
97   619 DATA 162,0,232,224,5,208
     ,251,136,1218
C8   620 DATA 192,255,208,239,198
     ,252,165,252,1761
9A   621 DATA 201,12,208,231,76,2
     11,10,0,949
F5   622 DATA 0,0,0,0,165,66,201,
     1,433
00   623 DATA 240,3,76,224,9,76,2
     11,10,849
E9   624 DATA 0,0,0,0,120,169,11,
     141,441
0C   625 DATA 17,208,169,53,133,1
     ,169,255,1005
6D   626 DATA 133,251,169,207,133
     ,252,160,0,1305
9A   627 DATA 177,251,133,2,160,8
     ,165,2,898
BE   628 DATA 74,133,2,176,31,169
     ,0,141,726
2D   629 DATA 24,212,234,234,234,
     136,208,238,1520
74   630 DATA 198,251,234,165,251
     ,201,255,208,1763
AE   631 DATA 8,198,252,165,252,2
     01,12,240,1328
26   632 DATA 14,76,199,241,234,2
     34,234,169,1401
1F   633 DATA 15,141,24,212,76,21
     9,241,76,1004
BB   634 DATA 211,10,234,96,160,0
     ,169,0,880
08   635 DATA 153,0,4,153,0,5,153
     ,0,468
50   636 DATA 6,153,0,7,153,0,216
     ,153,688
5E   637 DATA 0,217,153,0,218,153
     ,0,219,960
C2   638 DATA 200,208,229,160,0,1
     85,60,242,1284
2F   639 DATA 201,255,240,12,153,
     0,4,169,1034
55   640 DATA 1,153,0,216,200,76,
     38,242,926
70   641 DATA 76,119,242,32,32,16
     ,18,5,540
80   642 DATA 19,19,32,19,16,1,3,
     5,114
F1   643 DATA 32,20,15,32,19,20,1
     ,18,157
EC   644 DATA 20,32,19,1,13,16,12
     ,5,118
40   645 DATA 32,16,12,1,25,9,14,
     7,116
3D   646 DATA 32,255,0,165,65,201
     ,0,208,926
FD   647 DATA 3,76,211,10,201,1,2
     08,3,713
67   648 DATA 76,5,242,76,160,243
     ,32,240,1074
75   649 DATA 242,234,234,234,234
     ,120,169,11,1478
16   650 DATA 141,17,208,160,0,13
     2,251,169,1078
B0   651 DATA 12,133,252,177,251,
     141,24,212,1202
3E   652 DATA 173,1,220,201,251,2
     40,21,162,1269
D8   653 DATA 0,232,224,5,208,251
     ,200,208,1328
53   654 DATA 234,230,252,165,252
     ,201,208,208,1750
97   655 DATA 226,76,211,10,165,2
     51,141,119,1199
DA   656 DATA 2,165,252,141,120,2
     ,173,1,856
59   657 DATA 220,201,255,208,249
     ,177,251,141,1702
50   658 DATA 24,212,173,1,220,20
     1,239,240,1310
EA   659 DATA 18,162,0,232,224,5,
     208,251,1100
3A   660 DATA 200,208,234,230,252
     ,165,252,201,1742
5A   661 DATA 208,208,226,165,251
     ,141,121,2,1322
03   662 DATA 165,252,141,122,2,7
     6,0,243,1001
D4   663 DATA 0,0,0,0,0,0,0,173,1
     73
D2   664 DATA 1,220,201,239,208,2
     49,173,1,1292
4F   665 DATA 220,201,255,208,249
     ,96,0,173,1402
5F   666 DATA 120,2,141,113,240,1
     41,154,241,1152
F7   667 DATA 174,122,2,142,136,2
     40,202,142,1160
2B   668 DATA 129,241,76,211,10,0
     ,0,0,667
AE   669 DATA 169,12,141,113,240,
     141,47,241,1104
47   670 DATA 141,154,241,141,239
     ,241,162,208,1527
84   671 DATA 142,136,240,142,86,
     241,202,142,1331
89   672 DATA 129,241,142,196,241
     ,169,255,141,1514
E5   673 DATA 192,241,169,0,141,4
     3,241,76,1103
5F   674 DATA 211,10,0,169,12,141
     ,113,240,896
06   675 DATA 141,47,241,141,154,
     241,141,239,1345
CB   676 DATA 241,162,208,142,136
     ,240,142,86,1357
BA   677 DATA 241,202,142,129,241
     ,142,196,241,1534
7A   678 DATA 169,255,141,192,241
     ,169,0,141,1308
23   679 DATA 43,241,76,95,11,0,0
     ,169,635
B7   680 DATA 12,141,113,240,141,
     47,241,141,1076
FC   681 DATA 154,241,141,239,241
     ,162,208,142,1528
6D   682 DATA 136,240,142,86,241,
     202,142,129,1318
39   683 DATA 241,142,196,241,169
     ,255,141,192,1577
D5   684 DATA 241,169,0,141,43,24
     1,76,224,1135
88   685 DATA 9,0,0,0,0,0,0,160,1
     69
C7   686 DATA 0,169,0,153,0,4,153
     ,0,479
37   687 DATA 5,153,0,6,153,0,7,1
     53,477
BA   688 DATA 0,216,153,0,217,153
     ,0,218,957
B6   689 DATA 153,0,219,200,208,2
     29,160,0,1169
5E   690 DATA 185,60,242,201,255,
     240,12,153,1348
F1   691 DATA 0,4,169,1,153,0,216
     ,200,743
5F   692 DATA 76,193,243,173,1,22
     0,201,239,1346
56   693 DATA 208,249,173,1,220,2
     01,255,208,1515
1A   694 DATA 249,120,169,11,141,
     17,208,169,1084
72   695 DATA 0,133,251,169,12,13
     3,252,160,1110
E8   696 DATA 0,177,251,133,2,173
     ,1,220,957
3D   697 DATA 201,251,240,45,160,
     8,165,2,1072
7F   698 DATA 10,133,2,176,25,169
     ,0,141,656
0E   699 DATA 24,212,234,234,136,
     208,239,230,1517
A8   700 DATA 251,208,8,230,252,1
     65,252,201,1567
F1   701 DATA 208,240,11,76,240,2
     43,169,15,1202
B1   702 DATA 141,24,212,76,11,24
     4,76,211,995
92   703 DATA 10,165,251,141,119,
     2,165,252,1105
FB   704 DATA 141,120,2,173,1,220
     ,201,255,1113
A8   705 DATA 208,249,160,0,177,2
     51,133,2,1180
3F   706 DATA 173,1,220,201,239,2
     40,40,160,1274
BC   707 DATA 8,165,2,10,133,2,17
     6,23,519
12   708 DATA 169,0,141,24,212,76
     ,128,244,994
61   709 DATA 230,251,208,8,230,2
     52,165,252,1596
74   710 DATA 201,208,240,11,76,5
     9,244,169,1208
06   711 DATA 15,141,24,212,76,86
     ,244,165,963
51   712 DATA 251,141,121,2,165,2
     52,141,122,1195
1D   713 DATA 2,76,136,244,76,122
     ,244,234,1134
EA   714 DATA 136,208,198,76,89,2
     44,0,173,1124
0E   715 DATA 119,2,141,43,241,17
     3,120,2,841
33   716 DATA 141,47,241,174,122,
     2,173,121,1021
F1   717 DATA 2,201,128,176,6,142
     ,86,241,982
17   718 DATA 76,168,244,202,142,
     86,241,173,1332
7B   719 DATA 121,2,141,192,241,1
     73,122,2,994
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97 720 DATA 141,196,241,173,120,2,141,239,1253
31 721 DATA 241,76,211,10,0,0,0,165,703
1E 722 DATA 65,201,1,240,3,76,211,10,807
78 723 DATA 173,113,240,141,255,255,173,136,1486
29 724 DATA 240,141,255,255,0,0,0,0,891
68 725 DATA 0,0,0,0,0,0,0,120,120
A2 726 DATA 169,11,141,17,208,160,0,169,875
76 727 DATA 0,133,251,173,113,240,133,252,1295
29 728 DATA 177,251,141,24,212,162,0,232,1199
B7 729 DATA 224,5,208,251,234,234,200,208,1564
D9 730 DATA 239,230,252,165,252,205,136,240,1719
A9 731 DATA 208,230,76,11,245,0,0,120,890
CC 732 DATA 169,11,141,17,208,160,0,169,875
18 733 DATA 0,133,251,173,113,240,133,252,1295
47 734 DATA 177,251,141,24,212,162,0,232,1199
D4 735 DATA 224,1,208,251,200,208,241,230,1563
E5 736 DATA 252,165,252,205,136,240,208,232,1690
BB 737 DATA 96,0,0,0,0,0,0,160,256
19 738 DATA 0,169,1,153,0,216,185,88,812
45 739 DATA 245,201,255,240,7,153,0,4,1105
EB 740 DATA 200,76,66,245,76,116,11,32,822
E5 741 DATA 32,32,32,32,32,32,32,32,256
DA 742 DATA 32,32,21,19,5,32,20,8,169
59 743 DATA 5,19,5,32,11,5,25,19,121
2B 744 DATA 46,46,46,32,32,32,32,32,298
41 745 DATA 32,32,32,32,32,32,32,32,256
44 746 DATA 32,32,32,32,32,32,32,32,256
25 747 DATA 78,32,32,32,32,32,32,32,302
C2 748 DATA 32,32,32,32,32,32,32,32,256
8D 749 DATA 32,32,32,32,77,32,32,32,301
60 750 DATA 32,32,32,32,32,32,32,32,256
5B 751 DATA 32,32,32,32,32,32,32,32,256
25 752 DATA 32,17,32,23,32,5,32,18,191
C0 753 DATA 32,20,32,25,32,21,32,9,203
25 754 DATA 32,15,32,16,32,32,32,32,223
07 755 DATA 32,32,32,32,32,32,32,32,256
2A 756 DATA 32,32,32,32,32,32,32,32,256
F5 757 DATA 32,32,32,32,32,32,32,32,256
28 758 DATA 32,32,32,32,32,32,32,32,256
23 759 DATA 32,32,32,32,32,32,32,32,256
56 760 DATA 32,32,32,32,32,32,32,32,256
D1 761 DATA 32,32,32,32,32,32,32,32,256
9C 762 DATA 32,1,32,19,32,4,32,6,158
95 763 DATA 32,7,32,8,32,10,32,11,164
11 764 DATA 32,12,32,58,32,32,32,32,262
3D 765 DATA 32,32,32,32,32,32,32,32,256
F0 766 DATA 32,32,32,32,32,32,32,32,256
FB 767 DATA 77,32,32,32,32,32,32,32,301
39 768 DATA 32,32,32,32,32,32,32,32,256
34 769 DATA 32,32,32,32,78,32,32,32,302
D7 770 DATA 32,32,32,32,32,32,32,32,256
3A 771 DATA 32,32,32,32,32,32,32,32,256
C7 772 DATA 32,32,32,32,32,32,255,0,447
5A 773 DATA 0,0,0,0,0,80,0,141,221
CD 774 DATA 94,246,160,0,185,149,246,205,1285
21 775 DATA 94,246,240,8,200,192,21,208,1209
F5 776 DATA 243,76,116,11,192,10,176,12,836
3F 777 DATA 185,181,246,141,42,245,32,16,1088
DA 778 DATA 245,76,116,11,185,181,246,141,1201
40 779 DATA 253,246,32,16,247,76,116,11,997
FC 780 DATA 0,0,0,0,81,87,69,82,319
CE 781 DATA 84,89,85,73,79,80,65,83,638
1E 782 DATA 68,70,71,72,74,75,76,58,564
61 783 DATA 0,0,0,0,0,0,0,0,0
A8 784 DATA 0,0,0,0,10,9,8,7,34
BE 785 DATA 6,5,4,3,2,1,10,9,40
D3 786 DATA 8,7,6,5,4,3,2,1,36
25 787 DATA 0,0,0,0,0,0,0,0,0
24 788 DATA 0,0,0,0,0,0,0,0,0
CF 789 DATA 0,0,0,0,0,0,0,120,120
E5 790 DATA 169,11,141,17,208,169,53,133,901
11 791 DATA 1,160,255,169,0,133,251,169,1138
75 792 DATA 207,133,252,177,251,141,24,212,1397
20 793 DATA 162,0,232,224,10,208,251,136,1223
D3 794 DATA 192,255,208,239,198,252,165,252,1761
DC 795 DATA 201,128,208,231,96,0,0,173,1037
C1 796 DATA 125,241,141,237,246,173,129,241,1533
B2 797 DATA 141,241,246,173,154,241,141,10,1347
0F 798 DATA 247,76,224,246,0,0,0,0,793
5D 799 DATA 0,0,0,0,0,0,0,160,160
C8 800 DATA 0,185,72,247,201,255,240,12,1212
06 801 DATA 153,0,4,169,1,153,0,216,696
A9 802 DATA 200,76,50,247,76,164,11,32,856
6E 803 DATA 1,18,5,32,25,15,21,32,149
EC 804 DATA 19,21,18,5,32,25,15,21,156
75 805 DATA 32,23,9,19,8,32,20,15,158
51 806 DATA 32,5,18,1,19,5,32,19,131
A6 807 DATA 1,13,16,12,5,32,32,32,143
81 808 DATA 32,32,32,32,32,32,32,32,256
84 809 DATA 32,32,32,32,32,32,32,32,256
5F 810 DATA 32,32,32,32,32,32,32,32,256
02 811 DATA 32,32,32,32,32,32,32,32,256
6D 812 DATA 32,32,32,32,32,32,32,32,256
A0 813 DATA 32,32,32,32,32,32,32,32,256
95 814 DATA 32,32,32,32,32,32,32,25,249
D3 815 DATA 47,14,255,0,0,0,0,160,476
7A 816 DATA 0,169,0,133,251,169,12,133,867
32 817 DATA 252,169,0,145,251,200,208,251,1476
23 818 DATA 230,252,165,252,201,208,208,241,1757
0D 819 DATA 169,0,133,65,76,211,10,0,664
A5 820 DATA 0,0,0,0,160,0,169,0,329
9F 821 DATA 153,0,4,153,0,5,153,0,468
B3 822 DATA 6,153,0,7,153,0,216,153,688
69 823 DATA 0,217,153,0,218,153,0,219,960
7C 824 DATA 200,208,227,76,48,247,0,0,1006
5B 825 DATA 0,0,0,0,0,0,0,169,169
27 826 DATA 0,133,251,160,0,169,1,153,867
8E 827 DATA 0,216,153,0,217,153,0,218,957
B3 828 DATA 153,0,219,200,208,241,165,251,1437
43 829 DATA 201,0,208,3,76,49,248,201,986
35 830 DATA 1,208,3,76,91,248,201,2,830
59 831 DATA 208,3,76,133,248,76,175,248,1167
A9 832 DATA 169,52,133,1,160,0,185,0,700
5A 833 DATA 208,153,0,4,185,0,209,153,912
D0 834 DATA 0,5,185,0,210,153,0,6,559
56 835 DATA 185,0,211,153,0,7,200,208,964
5F 836 DATA 229,169,53,133,1,230,251,76,1142
26 837 DATA 202,11,169,52,133,1,160,0,728
DB 838 DATA 185,0,212,153,0,4,185,0,739
8D 839 DATA 213,153,0,5,185,0,214,153,923
E7 840 DATA 0,6,185,0,215,153,0,7,566
7F 841 DATA 200,208,229,169,53,133,1,230,1223
7E 842 DATA 251,76,202,11,169,52,133,1,895
10 843 DATA 160,0,185,0,216,153,0,4,718
B6 844 DATA 185,0,217,153,0,5,1
```

```
     85,0,745
FA   845 DATA 218,153,0,6,185,0,2
     19,153,934
02   846 DATA 0,7,200,208,229,169
     ,53,133,999
D5   847 DATA 1,230,251,76,202,11
     ,169,52,992
55   848 DATA 133,1,160,0,185,0,2
     20,153,852
C5   849 DATA 0,4,185,0,221,153,0
     ,5,568
7C   850 DATA 185,0,222,153,0,6,1
     85,0,751
C0   851 DATA 223,153,0,7,200,208
     ,229,169,1189
7B   852 DATA 53,133,1,230,251,76
     ,233,11,988
2B   853 DATA 0,0,0,0,0,0,0,0,0
2A   854 DATA 0,0,0,0,0,0,0,0,0
29   855 DATA 0,0,0,0,0,0,0,0,0
28   856 DATA 0,0,0,0,0,0,0,0,0
EF   857 DATA 0,0,0,0,0,0,0,0,0
EE   858 DATA 0,0,0,0,0,0,0,0,0
ED   859 DATA 0,0,0,0,0,0,0,0,0
EC   860 DATA 0,0,0,0,0,0,0,0,0
0B   861 DATA 0,0,0,0,0,0,0,28,28

61   862 DATA 8,10,0,158,50,57,48
     ,51,382
9D   863 DATA 32,169,72,69,78,32,
     84,72,608
C6   864 DATA 79,77,32,40,67,41,3
     9,56,431
32   865 DATA 56,0,0,0,0,0,169,14
     7,372
5A   866 DATA 32,176,8,169,11,141
     ,17,208,762
44   867 DATA 160,0,185,0,224,153
     ,0,4,726
0E   868 DATA 185,0,225,153,0,5,1
     85,0,753
52   869 DATA 226,153,0,6,185,0,2
     27,153,950
11   870 DATA 0,7,185,0,228,153,0
     ,216,789
D1   871 DATA 185,0,229,153,0,217
     ,185,0,969
C9   872 DATA 230,153,0,218,185,0
     ,231,153,1170
18   873 DATA 0,219,200,208,205,1
     69,0,32,1033
F5   874 DATA 60,9,234,234,234,16
     9,27,141,1108
76   875 DATA 17,208,32,228,255,2
     01,0,240,1181
2C   876 DATA 249,201,49,144,245,
     201,55,176,1320
1E   877 DATA 241,56,233,48,133,2
     51,201,6,1169
3F   878 DATA 208,3,76,102,254,16
     4,251,185,1243
97   879 DATA 159,8,133,252,185,1
     67,8,133,1045
22   880 DATA 253,108,252,0,141,3
     2,208,169,1163
28   881 DATA 55,133,1,88,96,0,19
     2,249,814
93   882 DATA 216,241,80,0,0,0,8,
     9,554
83   883 DATA 9,9,9,0,0,0,32,210,
     269
CA   884 DATA 255,120,169,53,133,
     1,96,169,996
33   885 DATA 55,133,1,88,96,0,16
     9,147,689
36   886 DATA 32,210,255,169,207,
     160,8,32,1073
FB   887 DATA 30,171,76,240,8,73,
     78,83,759
88   888 DATA 69,82,84,32,84,65,8
     0,69,565
81   889 DATA 32,38,32,80,82,69,8
     3,83,499
96   890 DATA 32.82.69.84.85.82.7
     8,0,512
64   891 DATA 0,0,0,0,0,0,32,228,
     260
40   892 DATA 255,201,13,240,7,16
     9,55,133,1073
B0   893 DATA 1,76,240,8,169,7,13
     3,1,635
C1   894 DATA 120,169,11,141,17,2
     08,173,13,852
EB   895 DATA 220,169,25,141,15,2
     20,173,13,976
F9   896 DATA 220,41,16,240,8,169
     ,15,141,850
1A   897 DATA 24,212,76,36,9,169,
     0,141,667
3C   898 DATA 24,212,173,1,220,20
     1,255,240,1326
44   899 DATA 229,169,63,133,0,16
     9,55,133,951
FD   900 DATA 1,169,27,141,17,208
     ,88,76,727
B4   901 DATA 32,8,141,32,208,141
     ,33,208,803
1E   902 DATA 169,55,133,1,88,96,
     0,0,542
81   903 DATA 0,0,0,0,0,0,169,147
     ,316
82   904 DATA 32,210,255,169,11,1
     41,17,208,1043
D8   905 DATA 120,169,53,133,1,16
     0,0,185,821
7F   906 DATA 0,232,153,0,4,185,0
     ,233,807
DD   907 DATA 153,0,5,185,0,234,1
     53,0,730
67   908 DATA 6,185,0,235,153,0,7
     ,185,771
A0   909 DATA 0,236,153,0,216,185
     ,0,237,1027
1C   910 DATA 153,0,217,185,0,238
     ,153,0,946
4D   911 DATA 218,185,0,239,153,0
     ,219,200,1214
A2   912 DATA 208,205,169,55,133,
     1,88,169,1028
F9   913 DATA 27,141,17,208,32,22
     8,255,201,1109
05   914 DATA 0,240,249,201,49,14
     4,245,201,1329
34   915 DATA 56,176,241,56,233,4
     8,133,251,1194
88   916 DATA 201,7,208,3,76,32,8
     ,164,699
DE   917 DATA 251,185,199,9,133,2
     52,185,207,1421
37   918 DATA 9,133,253,108,252,0
     ,118,8,881
3D   919 DATA 144,248,194,156,0,0
     ,10,10,762
60   920 DATA 11,10,11,11,0,0,120
     ,169,332
64   921 DATA 53,133,1,76,144,240
     ,169,63,879
7F   922 DATA 133,0,169,55,133,1,
     169,11,671
C1   923 DATA 141,17,208,88,76,32
     ,8,120,690
87   924 DATA 169,53,133,1,76,151
     ,240,120,943
BD   925 DATA 169,53,133,1,76,176
     ,240,169,1017
5D   926 DATA 0,133,65,76,32,8,16
     9,147,630
99   927 DATA 32,210,255,169,23,1
     60,10,32,891
54   928 DATA 30,171,76,43,10,67,
     85,82,564
D3   929 DATA 82,69,78,84,32,83,8
     0,69,577
ED   930 DATA 69,68,32,73,83,32,0
     ,0,357
15   931 DATA 0,120,169,53,133,1,
     174,125,775
BA   932 DATA 240,169,55,133,1,88
     ,169,0,855
F7   933 DATA 32,205,189,32,228,2
     55,201,0,1142
14   934 DATA 240,249,201,3,208,3
     ,76,80,1060
B2   935 DATA 9,201,43,240,7,201,
     45,240,986
8E   936 DATA 19,76,61,10,120,169
     ,53,133,641
6A   937 DATA 1,238,125,240,169,5
     5,133,1,962
E4   938 DATA 88,76,8,10,120,169,
     53,133,657
BC   939 DATA 1,206,125,240,169,5
     5,133,1,930
C7   940 DATA 88,76,8,10,169,147,
     32,210,740
BE   941 DATA 255,169,133,160,10,
     32,30,171,960
63   942 DATA 76,164,10,80,76,65,
     89,32,592
B1   943 DATA 83,65,77,80,76,69,3
     2,82,564
7D   944 DATA 69,86,69,82,83,69,3
     2,79,569
D6   945 DATA 82,32,70,79,82,87,6
     5,82,579
2B   946 DATA 68,0,32,228,255,201
     ,0,240,1024
56   947 DATA 249,201,82,240,7,20
     1,70,208,1258
5A   948 DATA 241,76,232,10,165,6
     5,201,0,990
5F   949 DATA 208,3,76,80,9,201,2
     ,240,819
77   950 DATA 8,120,169,53,133,1,
     76,239,799
36   951 DATA 10,120,169,53,133,1
     ,76,181,743
A4   952 DATA 241,169,63,133,0,16
     9,55,133,963
DC   953 DATA 1,169,11,141,17,208
     ,88,169,804
8E   954 DATA 0,133,66,76,80,9,16
     9,1,534
08   955 DATA 133,66,76,241,9,173
     ,125,240,1063
30   956 DATA 141,141,241,76,112,
     241,169,147,1268
FB   957 DATA 32,210,255,169,7,16
     0,11,32,876
01   958 DATA 30,171,76,49,11,83,
     69,76,565
B2   959 DATA 69,67,84,13,13,49,3
     2,45,372
D9   960 DATA 32,82,69,83,84,79,8
     2,69,580
CA   961 DATA 32,84,79,32,68,69,7
     0,65,499
F9   962 DATA 85,76,84,13,13,50,3
     2,45,398
A4   963 DATA 32,67,82,79,80,0,0,
     32,372
52   964 DATA 228,255,201,0,240,2
     49,201,3,1377
58   965 DATA 208,3,76,80,9,201,4
     9,240,866
8F   966 DATA 12,201,50,208,234,1
     20,169,53,1047
3F   967 DATA 133,1,76,100,242,12
     0,169,53,894
1A   968 DATA 133,1,76,25,243,120
     ,169,53,820
45   969 DATA 133,1,76,68,243,169
     ,55,133,878
B6   970 DATA 1,88,76,1,10,169,14
     7,32,524
F1   971 DATA 210,255,120,169,53,
     133,1,76,1017
A4   972 DATA 64,245,169,55,133,1
     ,88,32,787
7B   973 DATA 228,255,201,0,240,2
     49,201,3,1377
5A   974 DATA 208,3,76,211,10,120
```

```
      ,162,53,843
FD  975 DATA 134,1,76,96,246,0,1
      65,65,783
4B  976 DATA 201,1,208,3,76,103,
      11,76,679
7B  977 DATA 211,10,120,169,53,1
      33,1,76,773
8E  978 DATA 213,247,169,55,133,
      1,88,32,938
AA  979 DATA 228,255,201,78,208,
      3,76,211,1260
10  980 DATA 10,201,89,240,3,76,
      169,11,799
09  981 DATA 120,169,53,133,1,76
      ,176,247,975
CC  982 DATA 120,169,53,133,1,76
      ,0,248,800
EA  983 DATA 169,55,133,1,88,32,
      228,255,961
78  984 DATA 201,0,240,249,201,3
      ,208,3,1105
D5  985 DATA 76,211,10,201,32,20
      8,238,120,1096
EF  986 DATA 169,53,133,1,76,23,
      248,169,872
48  987 DATA 55,133,1,88,32,228,
      255,201,993
8B  988 DATA 32,208,249,76,211,1
      0,0,0,786
15  989 DATA 0,0,0,0,0,0,0,199,1
      99
E0  990 DATA -1
```

SET THE ALARM

PROGRAM: ALARM

```
3B  1 :
D6  2 REM          ALARM - BASIC LO
      ADER
9E  3 REM           N.P. GREGORY  0
      986
3E  4 :
F0  5 REM SYS 49152 : TURN OFF
24  6 REM SYS 49152,"A/PHHMM","A
      /PHHMM","STRING",1 - DISPLAY
       CLOCK
3D  7 :
86  10 RESTORE
BF  12 ADRS  = 49152
69  14 LINE  = 100
99  16 ELINE = 370
DB  18 C=0:T=0
2E  20 :
42  22 FOR LN = LINE TO ELINE ST
      EP 5
07  24 FOR A=0 TO 9
35  26 READ DT:IF DT=-1 THEN A=9
      :GOTO 30
F0  28 POKE ADRS+C,DT:T=T+DT:C=C
      +1:NEXT A
CE  30 READ CH:IF CH<>T THEN PRI
      NT"ERROR IN LINE";LN:END
0C  32 T=0:NEXT LN
B4  100 DATA 169,0,141,7,194,173
      ,13,220,9,4,930
A6  105 DATA 41,127,141,13,220,3
      2,121,0,208,13,916
C0  110 DATA 120,169,49,141,20,3
      ,169,234,141,21,1067
41  115 DATA 3,88,96,32,254,192,
      165,180,141,3,1154
F1  120 DATA 194,165,181,141,4,1
      94,32,254,192,165,1522
78  125 DATA 180,141,5,194,165,1
      81,141,6,194,32,1239
D9  130 DATA 253,174,32,158,173,
      32,163,182,201,27,1395
15  135 DATA 144,3,76,67,193,72,
      173,136,2,141,1007
25  140 DATA 98,192,141,128,192,
      141,141,192,56,32,1313
81  145 DATA 240,255,134,180,132
      ,181,173,0,4,133,1432
E1  150 DATA 182,104,168,169,0,1
      53,12,194,169,160,1311
F6  155 DATA 153,11,194,136,132,
      183,32,102,229,164,1336
8E  160 DATA 183,177,34,32,71,17
      1,173,0,4,9,854
30  165 DATA 128,153,11,194,136,
      16,233,165,182,141,1359
70  170 DATA 0,4,24,166,180,164,
      181,32,240,255,1246
96  175 DATA 32,121,0,240,14,32,
      253,174,32,158,1056
43  180 DATA 183,224,2,144,3,76,
      67,193,138,74,1104
B0  185 DATA 106,141,7,194,173,1
      4,220,9,128,141,1133
E5  190 DATA 14,220,173,15,220,9
      ,128,141,15,220,1155
4A  195 DATA 174,5,194,142,11,22
      0,174,6,194,142,1262
F5  200 DATA 10,220,160,0,140,9,
      220,140,8,220,1127
74  205 DATA 41,127,141,15,220,1
      73,3,194,141,11,1066
3D  210 DATA 220,173,4,194,141,1
      0,220,140,9,220,1331
6F  215 DATA 140,8,220,120,169,8
      7,141,20,3,169,1077
87  220 DATA 193,141,21,3,173,13
      ,220,9,132,141,1046
7B  225 DATA 13,220,88,96,32,253
      ,174,32,158,173,1239
12  230 DATA 32,163,182,201,5,24
      0,3,76,8,175,1085
2A  235 DATA 160,0,177,34,201,65
      ,240,4,201,80,1162
A7  240 DATA 208,241,132,180,201
      ,80,208,4,169,128,1551
20  245 DATA 133,180,169,19,133,
      182,32,43,193,200,1284
28  250 DATA 177,34,41,15,10,10,
      10,10,133,181,621
74  255 DATA 200,177,34,41,15,5,
      181,133,181,197,1164
1A  260 DATA 182,144,5,162,14,76
      ,55,164,166,182,1150
32  265 DATA 224,19,208,4,5,180,
      133,180,169,96,1218
33  270 DATA 133,182,96,173,7,19
      4,16,56,72,173,1102
C0  275 DATA 136,2,141,123,193,1
      41,223,193,141,250,1543
6F  280 DATA 193,160,28,162,1,17
      3,11,220,16,2,966
D1  285 DATA 162,16,133,2,138,9,
      128,153,0,4,745
24  290 DATA 165,2,41,127,170,32
      ,218,193,174,10,1132
8D  295 DATA 220,32,218,193,174,
      9,220,32,218,193,1509
3B  300 DATA 173,8,220,104,41,12
      7,208,9,173,13,1076
D0  305 DATA 220,16,58,41,4,240,
      54,160,0,174,967
D2  310 DATA 136,2,142,179,193,1
      85,10,194,240,15,1296
1D  315 DATA 77,9,194,153,0,4,17
      3,134,2,153,899
0B  320 DATA 0,216,200,208,236,1
      73,7,194,9,1,1244
02  325 DATA 141,7,194,206,8,194
      ,208,13,169,20,1160
16  330 DATA 141,8,194,173,9,194
      ,73,128,141,9,1070
0A  335 DATA 194,76,49,234,169,1
      74,200,153,0,4,1253
65  340 DATA 173,134,2,153,0,216
      ,138,41,240,74,1171
84  345 DATA 74,74,74,32,240,193
      ,41,15,24,105,872
2A  350 DATA 48,9,128,200,153,0,
      4,173,134,2,851
3D  355 DATA 153,0,216,138,96,0,
      0,0,0,0,603
8D  360 DATA 20,128,160,0,0,0,0,
      0,0,0,308
55  365 DATA 0,0,0,0,0,0,0,0,0,0
      ,0
4E  370 DATA 0,0,0,0,0,0,0,0,0,-
      1,0
```

JACK IN THE BOX

PROGRAM: BOXES LOADER

```
0B  5 PRINT"CREATING PROGRAM : [
      RVSON]BOX UTILS[RVSOFF,DOWN2
      ]"
AB  10 BL=47:LN=50:SA=52480
5B  20 FOR L=0 TO BL:CX=0:FOR D=
      0 TO 15:READ A:CX=CX+A:POKE
      SA+L*16+D,A:NEXT D
03  30 READ A:PRINT".";:IF A><CX
       THENPRINT"ERROR IN LINE";LN
      +(L*10):STOP
86  40 NEXT L
B9  50 DATA 32,155,183,142,32,20
      8,32,155,183,142,33,208,32,1
      55,183,142,2017
B3  60 DATA 134,2,32,155,183,142
      ,104,207,32,155,183,142,105,
      207,32,155,1970
C9  70 DATA 183,142,106,207,96,3
      2,155,183,142,95,207,32,155,
      183,142,96,2156
5E  80 DATA 207,32,155,183,142,9
      7,207,32,155,183,142,98,207,
      32,155,183,2210
C5  90 DATA 142,99,207,32,155,18
      3,142,100,207,32,155,183,142
      ,101,207,169,2256
00  100 DATA 146,32,210,255,32,1
      55,183,224,1,208,5,169,18,32
      ,210,255,2135
0E  110 DATA 234,174,134,2,142,1
      02,207,174,101,207,142,134,2
      ,169,32,174,2130
95  120 DATA 97,207,172,95,207,3
      2,51,206,200,204,96,207,208,
      247,232,236,2697
10  130 DATA 98,207,208,238,169,
      176,172,95,207,174,97,207,32
      ,51,206,169,2506
D8  140 DATA 189,172,96,207,174,
      98,207,32,51,206,169,173,172
      ,95,207,174,2422
37  150 DATA 98,207,32,51,206,16
      9,174,172,96,207,174,97,207,
      32,51,206,2179
62  160 DATA 172,95,207,200,169,
      195,174,97,207,32,51,206,174
      ,98,207,32,2316
58  170 DATA 51,206,174,99,207,2
      40,6,174,99,207,32,51,206,17
      4,100,207,2233
30  180 DATA 240,3,32,51,206,200
```

```
       ,204,96,207,208,219,172,95,2
       07,174,97,2411
B9  190 DATA 207,232,169,221,172
       ,95,207,32,51,206,172,96,207
       ,32,51,206,2356
99  200 DATA 232,236,98,207,208,
       238,173,99,207,240,19,169,17
       1,172,95,207,2771
F3  210 DATA 174,99,207,32,51,20
       6,169,179,172,96,207,32,51,2
       06,173,100,2154
26  220 DATA 207,240,19,169,171,
       172,95,207,174,100,207,32,51
       ,206,169,179,2398
C5  230 DATA 172,96,207,32,51,20
       6,234,169,19,32,210,255,174,
       102,207,142,2308
D4  240 DATA 134,2,96,72,24,32,2
       40,255,104,32,210,255,96,32,
       155,183,1922
71  250 DATA 142,95,207,32,155,1
       83,172,95,207,24,32,240,255,
       96,32,155,2122
E6  260 DATA 183,142,94,207,32,1
       55,183,173,94,207,232,142,89
       ,207,141,90,2371
65  270 DATA 207,174,134,2,142,1
       01,207,169,0,141,91,207,160,
       24,169,0,1928
7C  280 DATA 153,64,207,136,16,2
       48,32,34,207,32,228,255,240,
       251,141,92,2336
3C  290 DATA 207,201,20,208,41,1
       73,91,207,201,0,240,237,206,
       91,207,172,2502
9B  300 DATA 91,207,169,0,153,64
       ,207,32,58,207,169,32,32,210
       ,255,32,1918
AE  310 DATA 58,207,32,58,207,32
       ,34,207,32,58,207,76,19,207,
       173,91,1698
BD  320 DATA 207,24,105,1,205,89
       ,207,208,14,173,92,207,201,1
       3,240,7,1993
B0  330 DATA 201,20,240,3,76,121
       ,206,173,92,207,201,13,208,1
       5,32,58,1866
C1  340 DATA 207,169,32,32,210,2
       55,174,101,207,142,134,2,96,
       24,173,90,2048
09  350 DATA 207,201,1,240,17,17
       3,92,207,201,32,144,141,173,
       92,207,201,2329
8C  360 DATA 157,176,44,76,1,207
       ,173,92,207,201,48,144,34,20
       1,58,176,1995
4E  370 DATA 30,32,58,207,173,92
       ,207,32,210,255,172,91,207,1
       53,64,207,2190
82  380 DATA 238,91,207,173,91,2
       07,205,89,207,208,1,96,76,11
       8,206,76,2289
46  390 DATA 121,206,169,154,32,
       210,255,174,105,207,142,134,
       2,173,106,207,2397
22  400 DATA 32,210,255,174,104,
       207,142,134,2,96,169,157,32,
       210,255,96,2275
C8  410 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
36  420 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
3C  430 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
2A  440 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
10  450 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
1E  460 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
04  470 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
72  480 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
F0  490 DATA 0,205,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,205
66  500 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
6C  510 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
59  520 DATA 0,0,0,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0
05  530 PRINT "[DOWN2]PRESS ANY
       KEY TO SAVE MACHINE CODE"
D6  540 GETK$:IFK$=""THEN 540
5B  550 POKE43,0:POKE44,205:POKE
       45,0:POKE46,208:CLR:SAVE"BOX
        UTILS",8
24  560 REM ** CHANGE ,8 TO ,1 I
       F USING CASSETTE **
```

PROGRAM: BOX DEMO

```
D1  1000 :
FC  1010 F=F+1
50  1020 IFF=1THENLOAD"BOX UTILS
        ",8,1
48  1030 PRINT"[CLR]"
D2  1040 CO=52480 : REM CONFIG
05  1050 BO=52517 : REM BOX
12  1060 AT=52797 : REM PRINT AT
1C  1070 IN=52814 : REM INPUT RO
        UTINE
06  1080 :
56  1090 GOTO1150
6A  1100 :
AB  1110 SYSAT,9,24:PRINT"[RVSOF
        F,C7]PRESS A KEY TO CONTINUE
        ";
4D  1120 GETA$:IFA$=""THEN1120
E0  1130 RETURN
42  1140 :
10  1150 SYSCO,6,6,1,4,7,ASC("[C
        P]")
27  1160 SYSBO,5,35,4,8,0,0,1,0
A1  1170 SYSAT,12,6:PRINT"[C7]WE
        LCOME TO BOXES"
90  1180 GOSUB1110
E8  1190 PRINT"[CLR]"
16  1200 SYSBO,0,39,0,23,0,0,14,
        1
4B  1210 SYSAT,3,5
45  1220 PRINT"[C7]BOXES PROVIDE
        S THE BASIC PROGRAMMER"
A7  1230 PRINT"[RVSON,RIGHT3]WIT
        H SEVERAL FUNCTIONS:"
45  1240 PRINT
22  1250 PRINT"[RIGHT3,RVSON]CON
        FIG"
F7  1260 PRINT"[RIGHT3,RVSON]AT"
3F  1270 PRINT"[RIGHT3,RVSON]DRA
        W BOX"
CF  1280 PRINT"[RIGHT3,RVSON]INP
        UT"
83  1290 GOSUB1110
53  1300 PRINT"[CLR]"
00  1310 SYSBO,0,39,0,10,0,0,14,
        0
18  1320 SYSAT,1,1
14  1330 PRINT"[RIGHT,WHITE]AT.[
        C7] THIS ALLOWS THE CURSOR T
        O BE"
BF  1340 PRINT"[RIGHT6]PLACED ON
         THE SCREEN"
09  1350 PRINT"[RIGHT3,DOWN,RIGH
        T3]USING COORDINATES X,Y"
83  1360 PRINT"[RIGHT6]THIS IS U
        SEFUL IF YOU REQUIRE"
F4  1370 PRINT"[RIGHT6]EXTENSIVE
         CURSOR MOVEMENT"
65  1380 GOSUB1110
C1  1390 PRINT"[CLR]"
89  1400 SYSBO,0,39,0,20,0,0,14,
        0
A3  1410 PRINT"[HOME,DOWN,RIGHT,
        WHITE]BOX DRAW[C7] THIS ALLO
        WS DISPLAY OF BOXES"
3D  1420 SYSAT,1,2:PRINT"ON THE
        COMMODORE SCREEN"
90  1430 SYSAT,1,4:PRINT"CARE SH
        OULD BE TAKEN NOT TO USE THE
        "
9D  1440 SYSAT,1,5:PRINT"BOTTOM
        RIGHT CHARACTER ON THE SCREE
        N"
9D  1450 SYSAT,1,7:PRINT"BOXES C
        AN BY DRAWN BE SPECIFYING"
B7  1460 SYSAT,1,9:PRINT"START X
        ,END X,START Y,END Y"
62  1470 SYSAT,1,10:PRINT"NEXT,
        2 VERTICAL BARS MAY BE PLACE
        D ON"
95  1480 SYSAT,1,11:PRINT"THESE
        ARE SHOWN IN B1 AND B2"
4E  1490 SYSAT,1,12:PRINT"THE NE
        XT PARAMETER, C1 IS THE COLO
        R"
DB  1500 PRINT"[RIGHT]FINALLY, T
        HE LAST FLAG IS SET"
8C  1510 PRINT"[RIGHT]1 INDICATE
        S A REVERSE BOX"
CC  1520 PRINT"[RIGHT]ANY OTHER
        INDICATES A NORMAL FRAME"
F3  1530 GOSUB1110
EE  1540 PRINT"[CLR]HERE ARE THE
         TWO TYPES OF BOXES"
7D  1550 SYSBO,5,35,5,10,0,0,14,
        0
6D  1560 SYSBO,5,35,11,16,0,0,14
        ,1
31  1570 SYSAT,6,6:PRINT"[RVSOFF
        ]NORMAL"
11  1580 SYSAT,6,12:PRINT"[RVSON
        ]REVERSE"
34  1590 GOSUB1110
B4  1600 PRINT"[CLR]"
4C  1610 SYSBO,1,19,0,3,0,0,1,0
DF  1620 SYSBO,20,38,0,3,0,0,2,0
02  1630 SYSBO,1,19,4,7,0,0,3,0
9D  1640 SYSBO,20,38,4,7,0,0,4,0
AD  1650 SYSBO,1,19,8,11,0,0,5,0
DE  1660 SYSBO,20,38,8,11,0,0,6,
        0
8A  1670 SYSBO,1,19,12,15,0,0,7,
        0
0B  1680 SYSBO,20,38,12,15,0,0,8
        ,0
90  1690 SYSBO,1,19,16,19,0,0,9,
        0
BE  1700 SYSBO,20,38,16,19,0,0,1
        0,0
69  1710 SYSBO,1,19,20,23,0,0,11
        ,0
6A  1720 SYSBO,20,38,20,23,0,0,1
        2,0
48  1730 GOSUB1110
20  1740 PRINT"[CLR]"
19  1750 SYSBO,1,19,0,3,0,0,1,1
02  1760 SYSBO,20,38,0,3,0,0,2,1
0F  1770 SYSBO,1,19,4,7,0,0,3,1
28  1780 SYSBO,20,38,4,7,0,0,4,1
00  1790 SYSBO,1,19,8,11,0,0,5,1
40  1800 SYSBO,20,38,8,11,0,0,6,
        1
90  1810 SYSBO,1,19,12,15,0,0,7,
        1
BB  1820 SYSBO,20,38,12,15,0,0,8
        ,1
9E  1830 SYSBO,1,19,16,19,0,0,9,
        1
```

```
E0  1840 SYSBO,20,38,16,19,0,0,1
    0,1
A7  1850 SYSBO,1,19,20,23,0,0,11
    ,1
36  1860 SYSBO,20,38,20,23,0,0,1
    2,1
59  1870 GOSUB1110
9D  1880 PRINT"[CLR]"
A3  1890 SYSAT,15,0:PRINT"DATA I
    NPUT"
A0  1900 PRINT"[DOWN2,RIGHT]PLEA
    SE ENTER A WORD:"
0B  1910 SYSIN,0,10
58  1920 A$=""
F3  1930 FORL=0TO9
9D  1940 A$=A$+CHR$(PEEK(53056+L
    ))
73  1950 NEXTL
C0  1960 B$=A$
F6  1970 PRINT"[DOWN2]PLEASE ENT
    ER A NUMBER:"
90  1980 SYSIN,1,10
06  1990 A$=""
89  2000 FORL=0TO9:A$=A$+CHR$(PE
    EK(53056+L)):NEXTL
5D  2010 SYSAT,0,10
FE  2020 PRINT"[C7]WORD TYPED :
    [WHITE]";B$
DC  2030 PRINT"[C7]NUMBER TYPED
    : [WHITE]";VAL(A$)
F3  2040 GOSUB1110
48  2050 PRINT"[CLR]"
80  2060 OPT=1
FA  2070 SYSBO,8,34,1,5,0,0,1,1
EE  2080 SYSAT,16,2:PRINT"[WHITE
    ]BOX MENU"
BA  2090 SYSAT,10,3:PRINT"[RVSON
    ]USE CURSORS UP AND DOWN"
B7  2100 SYSAT,12,4:PRINT"[RVSON
    ]RETURN TO FINISH"
45  2110 SYSBO,10,30,10,12,0,0,1
    ,1
3D  2120 SYSBO,10,30,13,15,0,0,1
    4,1
8D  2130 SYSBO,10,30,16,18,0,0,1
    4,1
34  2140 SYSBO,10,30,19,21,0,0,1
    4,1
A5  2150 GETA$:IFA$=""THEN2150
85  2160 IFA$=CHR$(13)THENGOTO23
    00
E9  2170 IFA$="[DOWN]"ANDOPT=4TH
    ENOPT=1:GOTO2190
3F  2180 IFA$="[DOWN]"THENOPT=OP
    T+1
F6  2190 IFA$="[UP]"ANDOPT=1THEN
    OPT=4:GOTO2210
5A  2200 IFA$="[UP]"THENOPT=OPT-
    1
9D  2210 SYSBO,10,30,10,12,0,0,1
    4,1
11  2220 SYSBO,10,30,13,15,0,0,1
    4,1
89  2230 SYSBO,10,30,16,18,0,0,1
    4,1
B0  2240 SYSBO,10,30,19,21,0,0,1
    4,1
41  2250 IFOP=1THENSYSBO,10,30,1
    0,12,0,0,1,1
72  2260 IFOP=2THENSYSBO,10,30,1
    3,15,0,0,1,1
83  2270 IFOP=3THENSYSBO,10,30,1
    6,18,0,0,1,1
B5  2280 IFOP=4THENSYSBO,10,30,1
    9,21,0,0,1,1
F9  2290 GOTO2150
4E  2300 PRINT"[CLR]"
FA  2310 SYSBO,1,19,1,10,0,0,14,
    0
13  2320 SYSBO,1,19,11,20,13,18,
    14,0
8B  2330 SYSBO,20,38,1,10,0,0,14
    ,1
E6  2340 SYSBO,20,38,11,20,13,18
    ,14,1
3B  2350 GOSUB1110
8B  2360 PRINT"[CLR]"
B6  2370 SYSAT,6,2
EB  2380 PRINT"BOXES BY S.SCOTT
    - JUNE 1988"
DF  2390 END
```

FILE EXTENSION

PROGRAM: FILE EXTENSION

```
0 DIMB$(255),B(255):PRINT"(CLR)(
WHT)INSERT DISK & PRESS (RVS)RET
URN":POKE53280,0:POKE53281,0
1 GETA$:IFA$<>CHR$(13)THEN1:DATA
",8:","▖▔┘",",8,1","▖▔▖┴",":","┘
"
2 M=1:OPEN4,4:OPEN15,8,15,"I":IN
PUT#15,E:CLOSE15:IFE<>0THEN0
3 PRINT"(CLR)(RVS)";:OPEN15,8,15
:FORT=1TO3:READA$(T),C$(T):NEXT:
OPEN5,8,0,"$"
4 FORT=1TO7:GET#5,A$:NEXT
5 GET#5,A$:IFSTTHEN9
6 IFA$<>CHR$(34)THEN5
7 FORT=1TO21:GET#5,A$:B$(N)=B$(N
)+A$:IFA$=CHR$(34)THENB(N)=T
8 NEXT:PRINTCHR$(34)B$(N):N=N+1:
GETA$:IFA$<>" "THEN4
9 PRINT"(CLR)(YEL)FILE NAME:(WHT
)"CHR$(34)B$(M)"(DOWN)(DOWN)":FO
RT=1TO3:PRINT"(YEL)(DOWN)(LEFT)"
T"(WHT)  "A$(T):NEXT
10 PRINT"(DOWN)(YEL)-(WHT) SCRAT
CH(DOWN)":PRINT"(YEL)@ (WHT)DISK
 COMMAND(DOWN)":PRINT"(YEL)S (WH
T)DISK STATUS":CLOSE5
11 P$="
 ":PRINT"(DOWN)(YEL)R (WHT)RENAM
E":PRINT"(DOWN)(YEL)P (WHT)HARD
COPY"
12 GETA$:PRINT"(HOME)"TAB(11)B$(
M):IFA$="(DOWN)"ANDM<N-1THENM=M+
1:GOTO12
13 IFA$="(UP)"ANDM>1THENM=M-1:GO
TO12
14 IFA$=""THEN12
15 IFA$="(CLR)"THENM=N-1
16 IFA$="(HOME)"THENM=1
17 IFA$="S"THENPRINT"(HOME)(DOWN
)(DOWN)"P$:INPUT#15,W,X$,Y,Z:PRI
NT"(UP)"W;X$Y;Z:GOTO12
18 IFA$="@"THENINPUT"(CLR)(YEL)C
OMMAND(WHT)";A$:PRINT#15,A$:GOTO
9
19 IFA$="P"THENPRINT#4,"(RVS)";:
FORT=0TON-1:PRINT#4,CHR$(34)B$(T
):NEXT
20 IFB$(M)=P$THEN12
21 IFA$="-"THENPRINT#15,"S:"+LEF
T$(B$(M),B(M)-1):B$(M)=P$
22 IFA$="R"THENC$=LEFT$(B$(M),B(
M)-1):D$=RIGHT$(B$(M),3):GOTO29
23 A=VAL(A$):IFA>0ANDA<4THENC$=L
EFT$(B$(M),B(M)-1):D$=RIGHT$(B$(
M),3):GOTO26
24 IFA$=" "THENRUN
25 GOTO12
26 IFLEN(C$)+LEN(C$(A))>15THEN12
27 PRINT#15,"R:"C$"."C$(A)"="C$:
E$=C$+CHR$(34)+A$(A)
28 B$(M)=LEFT$(E$+P$,18)+D$:GOTO
12
29 PRINT"(CLR)(YEL)OLD FILE NAME
 = (WHT)"C$:PRINTTAB(16)"(BLU)(D
OWN)(DOWN)(DOWN)----------------
(UP)(UP)"
30 INPUT"(YEL)NEW FILE NAME (WHT
)";Z$:IFZ$=""THEN9
31 B$(M)=LEFT$((Z$)+CHR$(34)+P$,
18)+D$
32 PRINT#15,"R:"Z$"="C$:B(M)=LEN
(Z$)+1:Z$="":GOTO9
```

HI-RES COLOUR PLOTTER

PROGRAM: PLOT64 LOADER

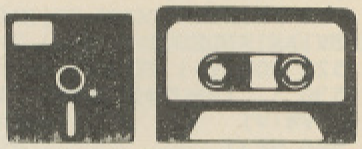
```
79  10 FORA=49152TO50175STEP16:D
    =0
25  20 FORB=0TO15:READC:POKEA+B,
    C:D=D+C:NEXT
74  30 READCH:IFD<>CHTHENPRINT"C
    HECKSUM ERROR IN LINE"PEEK(6
    3)+256*PEEK(64):END
21  40 NEXT:POKE50176,96:END
E8  500 DATA32,253,174,32,235,18
    3,165,21,141,2,196,240,10,20
    1,2,176,2063
20  501 DATA15,165,20,201,64,176
    ,9,165,20,141,1,196,224,200,
    144,3,1744
86  502 DATA76,72,178,142,3,196,
    32,165,194,32,63,193,72,174,
    8,196,1796
F5  503 DATA240,119,166,254,208,
    16,1,251,129,251,104,169,4,3
    2,148,193,2285
96  504 DATA173,7,196,129,251,96
    ,174,8,196,224,1,208,36,202,
    73,255,2229
B9  505 DATA33,251,129,251,104,7
    4,1,251,129,251,169,4,32,148
    ,193,173,2193
64  506 DATA7,196,10,10,10,10,13
    3,253,161,251,41,15,5,253,12
    9,251,1735
89  507 DATA96,224,2,208,29,162,
    0,1,251,129,251,104,74,73,25
    5,33,1892
E1  508 DATA251,129,251,169,4,32
    ,148,193,161,251,41,240,13,7
    ,196,129,2215
A4  509 DATA251,96,162,0,1,251,1
    29,251,104,74,1,251,129,251,
    169,216,2336
63  510 DATA32,148,193,173,7,196
    ,129,251,96,73,255,33,251,12
    9,251,104,2321
6A  511 DATA164,254,240,7,74,73,
    255,33,251,129,251,96,32,253
    ,174,32,2318
DB  512 DATA235,183,165,21,141,2
    ,196,240,10,201,2,176,15,165
    ,20,201,1973
EE  513 DATA64,176,9,165,20,141,
    1,196,224,200,144,3,76,72,17
    8,142,1811
4A  514 DATA3,196,32,63,193,166,
    254,208,16,33,251,141,16,196
    ,169,4,1941
A7  515 DATA32,148,193,161,251,1
    41,17,196,96,72,162,0,33,251
    ,208,28,1989
E5  516 DATA104,74,33,251,141,16
    ,196,208,4,141,17,196,96,169
    ,4,32,1682
```

```
98   517 DATA148,193,161,251,74,7
     4,74,74,141,17,196,96,141,16
     ,196,104,1956
FC   518 DATA74,33,251,208,13,169
     ,4,32,148,193,161,251,41,15,
     141,17,1751
CE   519 DATA196,96,169,216,32,14
     8,193,161,251,41,15,141,17,1
     96,96,169,2137
F3   520 DATA0,133,251,169,32,133
     ,252,173,1,196,41,248,24,101
     ,251,133,2138
FA   521 DATA251,165,252,109,2,19
     6,133,252,173,3,196,41,248,1
     33,253,162,2569
DF   522 DATA5,32,200,193,162,3,3
     2,200,193,173,3,196,41,7,101
     ,251,1792
90   523 DATA133,251,144,2,230,25
     2,173,1,196,41,7,166,254,240
     ,2,41,2133
5B   524 DATA6,133,253,56,169,7,2
     29,253,170,169,1,224,0,240,4
     ,10,1924
32   525 DATA202,208,252,96,133,2
     52,169,0,133,251,173,1,196,7
     4,74,74,2288
EA   526 DATA174,2,196,240,2,9,32
     ,24,101,251,133,251,144,3,23
     0,252,2044
EA   527 DATA24,173,3,196,41,248,
     133,253,162,2,32,200,193,165
     ,253,101,2179
FA   528 DATA251,133,251,144,2,23
     0,252,96,169,0,141,15,196,16
     5,253,10,2308
EB   529 DATA46,15,196,202,208,24
     9,101,251,133,251,165,252,10
     9,15,196,133,2522
FB   530 DATA252,96,32,253,174,32
     ,235,183,165,20,141,1,196,16
     5,21,141,2107
37   531 DATA2,196,142,3,196,32,2
     53,174,32,235,183,165,20,141
     ,4,196,1974
F0   532 DATA165,21,141,5,196,142
     ,6,196,32,165,194,24,173,1,1
     96,141,1798
42   533 DATA12,196,109,4,196,141
     ,9,196,173,2,196,141,13,196,
     109,5,1698
B9   534 DATA196,141,10,196,240,1
     1,201,2,176,23,173,9,196,201
     ,64,176,2015
3F   535 DATA16,173,3,196,141,14,
     196,109,6,196,141,11,196,201
     ,200,144,1943
E6   536 DATA3,76,72,178,32,41,19
     2,173,1,196,205,9,196,208,8,
     173,1763
BF   537 DATA2,196,205,10,196,240
     ,10,238,1,196,208,3,238,2,19
     6,208,2149
CF   538 DATA227,32,41,192,173,3,
     196,205,11,196,240,5,238,3,1
     96,208,2166
6E   539 DATA240,32,41,192,173,1,
     196,205,12,196,208,8,173,2,1
     96,205,2080
6E   540 DATA13,196,240,15,206,1,
     196,173,1,196,201,255,208,22
     7,206,2,2336
B9   541 DATA196,240,222,32,41,19
     2,173,3,196,205,14,196,240,6
     ,206,3,2165
5D   542 DATA196,76,147,194,96,32
     ,241,183,165,254,240,4,224,1
     6,176,20,2264
7A   543 DATA142,7,196,32,241,183
     ,165,254,240,6,224,4,144,9,1
     76,4,2027
66   544 DATA224,2,144,3,76,72,17
     8,142,8,196,96,169,0,133,251
     ,168,1862
97   545 DATA169,32,133,252,152,1
     62,31,145,251,136,208,251,23
     0,252,202,208,2814
9E   546 DATA246,160,64,136,145,2
     51,208,251,96,173,24,208,9,8
     ,141,24,2144
E6   547 DATA208,173,17,208,9,32,
     141,17,208,165,254,240,8,173
     ,22,208,2083
3A   548 DATA9,16,141,22,208,96,1
     73,24,208,41,247,141,24,208,
     173,17,1748
B8   549 DATA208,41,223,141,17,20
     8,173,22,208,41,239,141,22,2
     08,96,32,2020
8E   550 DATA241,183,165,254,240,
     4,224,16,176,9,134,253,32,24
     1,183,224,2579
C8   551 DATA16,144,3,76,72,178,1
     42,32,208,165,253,166,254,24
     0,4,141,2094
04   552 DATA33,208,96,162,250,20
     2,157,0,4,157,250,4,157,244,
     5,157,2086
9A   553 DATA238,6,208,241,96,32,
     241,183,224,1,240,7,224,8,24
     0,3,2192
E9   554 DATA76,72,178,169,1,160,
     255,32,186,255,165,157,240,1
     ,96,169,2212
E9   555 DATA28,141,136,2,169,13,
     32,210,255,169,64,141,252,3,
     169,80,1864
64   556 DATA141,253,3,169,73,141
     ,254,3,169,67,141,255,3,169,
     4,162,2007
87   557 DATA252,160,3,32,189,255
     ,169,0,133,251,169,32,133,25
     2,169,251,2450
82   558 DATA162,64,160,63,32,216
     ,255,169,0,32,189,255,169,4,
     133,252,2155
7A   559 DATA169,251,162,232,160,
     7,32,216,255,165,254,240,13,
     169,216,133,2674
DF   560 DATA252,169,251,162,232,
     160,219,32,216,255,169,4,141
     ,136,2,96,2496
6D   561 DATA32,241,183,224,1,240
     ,7,224,8,240,3,76,72,178,169
     ,1,1899
5D   562 DATA168,32,186,255,165,1
     57,240,1,96,32,189,255,162,2
     ,165,254,2359
E1   563 DATA240,1,232,134,253,6,
     253,169,0,32,213,255,198,253
     ,208,247,2694
```

PROGRAM: PLOT64 DEMO

```
22   10 DEFFNA(X)=INT(RND(1)*X)
8D   20 POKE254,1:SYS49867:SYS498
     97:SYS49951,0,0:SYS49634,0,0
     ,319,199,1,1:PL=49152
69   30 FORZ=1TO100
B1   40 SYSPL,FNA(320),FNA(200),1
     ,1
62   50 NEXT:C=9
E1   60 FORP=0TO1:IFP=1THENC=14
DC   70 XC=180-60*P:YC=110-40*P:S
     =35-15*P
FD   80 FORK=-STOS
0A   90 X=SQR(S*S-K*K):X2=2*X
2A   100 SYSPL,XC-X-1,YC-K,C,1
80   110 FORL=-XTOXSTEP2.5:PO=1
9A   120 IFFNA(X2)-X>=LTHENPO=0
77   130 SYSPL,XC+L,YC-K,C,PO
3D   140 NEXTL,K,P
95   150 GOTO150
```

CONSTRUCT A COMPILER



PROGRAM: CODEGEN

```
FB   10 GOSUB 150
40   20 IF DE% THEN PRINT "[SD]IS
     K [SF]ILE ERROR! [SA]BORTING
     [SC]ODEGEN.":END
8C   30 GOSUB 780
7C   40 IF DE% THEN PRINT "[SD]IS
     K [SF]ILE ERROR! [SA]BORTING
     [SC]ODEGEN.":END
08   50 :
59   60 GOSUB 1090
E1   70 IF VT%>1 THEN GOSUB 1880
EA   80 IF TT%>1 THEN GOSUB 2150
FB   90 GOSUB 2330
5E   100 :
3B   110 PRINT#3,CHR$(0);CHR$(0);

9C   120 CLOSE 3:CLOSE 2:PRINT "[
     SS]TARTING ASSEMBLER..":CLR:
     LOAD"ASSEMBLE",8,1
B8   130 :
B6   140 :
CF   150 REM *******************
     ***********
08   160 REM SETUP THE SYSTEM FOR
     CODEGEN
DB   170 REM *******************
     ***********
8E   180 :
94   190 PRINT "[CLR,SF,SC,SL] [S
     C]OMPILER [SS]YSTEM [SV]ERSI
     ON 1.0"
4D   200 PRINT "[SC]ODEGEN [SV]1.
     0[SB]"
20   210 PRINT "[SC]OMMODORE 64 [
     SV]ERSION"
7E   220 PRINT "[SS]TEVE [SC]ARRI
     E 1988[DOWN2]"
DA   230 DIM SL$(200)
D0   240 GOSUB 320
39   250 GOSUB 420:IF DE% THEN RE
     TURN
58   260 GOSUB 590:IF DE% THEN RE
     TURN
35   270 :
23   280 :
AD   290 RETURN
17   300 :
0D   310 :
C4   320 REM *******************
     ***********
FB   330 REM GET FILENAME
D0   340 REM *******************
     ***********
65   350 :
21   360 F$=""
30   370 INPUT "[SF]ILENAME";F$
A5   380 IF F$="" THEN 370
09   390 RETURN
AB   400 :
A1   410 :
20   420 REM *******************
     ***********
CE   430 REM READ IN SYM FILE
2C   440 REM *******************
     ***********
F9   450 :
F8   460 OPEN 2,8,2,F$+".SYM,S,R"

BB   470 IF DS OR ST THEN DE%=-1:
     RETURN
6A   480 INPUT#2,VT%
51   490 IF VT%=1 THEN CLOSE 2:RE
     TURN
71   495 IF ST THEN CLOSE 2:DE%=-
     1:RETURN
```

```
62   500 DIM VN$(VT%+1),VT%(VT%+1
     ),VV%(VT%+1)
BE   510 PRINT "[DOWN,SR]EADING [
     SV]ARIABLES."
A1   520 FOR V=1 TO VT%-1
EF   530 :  INPUT#2,VN$(V),VT%(V)
     ,VV%(V)
9C   540 NEXT
9A   550 CLOSE 2
BC   560 RETURN
06   570 :
7C   580 :
FF   590 REM ********************
     **********
99   600 REM READ LITERALS
CB   610 REM ********************
     **********
54   620 :
70   630 OPEN 2,8,2,F$+".LTR,S,R"

FA   640 IF DS OR ST THEN DE%=-1:
     RETURN
63   650 INPUT#2,TT%
E6   660 IF TT%=1 THEN CLOSE 2:RE
     TURN
5C   665 IF ST THEN DE%=-1:RETURN

93   670 DIM LT$(TT%+1),L%(TT%+1)

6D   680 PRINT "[SR]EADING LITERA
     LS."
1B   690 FOR LT=1 TO TT%-1
92   700 :  INPUT#2,LE%:L%(LT)=LE
     %
3C   710 :  LT$=""
95   720 :  IF LE%<>0 THEN FOR Y=
     1 TO LE%:GET#2,A$:LT$(LT)=LT
     $(LT)+A$:NEXT
5E   730 NEXT
54   740 CLOSE 2
7E   750 RETURN
C0   760 :
3F   770 :
36   780 REM ********************
     ***********
BC   790 REM OPEN WORK FILES
62   800 REM ********************
     ***********
17   810 :
3F   820 OPEN 2,8,2,F$+".SFC,S,R"

3D   830 IF DS OR ST THEN DE%=-1:
     RETURN
71   840 :
D2   850 OPEN 3,8,3,"@0:"+F$+".AS
     M,P,W"
3F   860 IF DS OR ST THEN DE%=-1:
     CLOSE2:RETURN
2F   870 PRINT#3,CHR$(1);CHR$(8);

FD   880 RETURN
47   890 :
BD   900 :
14   910 REM ********************
     ***********
A0   920 REM OUTPUT ASM LINE
20   930 REM ********************
     ***********
95   940 :
EB   950 PRINT#3,CHR$(255);CHR$(0
     );CHR$(0);CHR$(0);OL$;CHR$(0
     );
D3   960 TL=TL+1:PRINT TL;"[LEFT]
     LINES.[SPC6]":PRINT"[UP]";
43   970 RETURN
ED   980 :
DB   990 :
1A   1000 REM ******************
     ************
50   1010 REM OUTPUT LIBRARY CALL
     LINE
26   1020 REM ******************
     ************
30   1030 :
81   1040 GOSUB 910
4A   1050 OL$=" JSR SYSLIB"
19   1060 GOTO 910
08   1070 :
06   1080 :
7F   1090 REM ******************
     ************
5B   1100 REM GENERATE PROGRAM HE
     ADER
8B   1110 REM ******************
     ************
5E   1120 :
B2   1130 PRINT "[SG]ENERATING [S
     P]ROGRAM [SH]EADER."
3B   1140 OL$="; [SC]ODEGEN [SV]1
     .0[SB]":GOSUB 910
BE   1150 OL$="; [SC]64 [SV]ERSIO
     N":GOSUB 910
C7   1160 OL$=";":GOSUB 910
8D   1170 OL$=" ORG $0801":GOSUB
     910
24   1180 OL$=".BASIC":GOSUB 910
9E   1190 OL$=" BYT $0C,$08,$0A,$
     00,$9E,$20,$32":GOSUB 910
29   1200 OL$=" BYT $30,$36,$33,$
     00,$00,$00,$00":GOSUB 910
EA   1210 OL$=" JSR LOADLIB":GOSU
     B 910
BC   1220 OL$=" JMP MAINSTART":GO
     SUB 910
E1   1230 OL$=";":GOSUB 910
96   1240 OL$="; ***** PROGRAM VA
     RIABLES *****":GOSUB 910
7C   1250 OL$=".AC1 EQZ $03":GOSU
     B 910
51   1260 OL$=".AC2 EQZ $05":GOSU
     B 910
C8   1270 OL$=".SD1 EQZ $26":GOSU
     B 910
FF   1280 OL$=".SD2 EQZ $3F":GOSU
     B 910
E1   1290 OL$=".UP1 EQZ $FB":GOSU
     B 910
C0   1300 OL$=".UP2 EQZ $FD":GOSU
     B 910
CB   1310 OL$=".APT EQZ $45":GOSU
     B 910
6B   1320 OL$=".TT1 EQZ $47":GOSU
     B 910
B3   1330 OL$=".SYSLIB EQZ $5E":G
     OSUB 910
9E   1340 OL$=";":GOSUB 910
18   1350 OL$=".LOADLIB":GOSUB 91
     0
33   1360 OL$=" LDA #2":GOSUB 910

50   1370 OL$=" LDY #1":GOSUB 910

92   1380 OL$=" LDX #8":GOSUB 910

E3   1390 OL$=" JSR $FFBA":GOSUB
     910
C7   1400 OL$=" LDA #6":GOSUB 910

EB   1410 OL$=" LDX #<SYSLIBNAME"
     :GOSUB 910
96   1420 OL$=" LDY #>SYSLIBNAME"
     :GOSUB 910
F6   1430 OL$=" JSR $FFBD":GOSUB
     910
8D   1440 OL$=" LDA #0":GOSUB 910
92   1450 OL$=" TAX":GOSUB 910
DC   1460 OL$=" LDY #$C0":GOSUB 9
     10
E5   1470 OL$=" JSR $FFD5":GOSUB
     910
5E   1480 OL$=" BCS LDERR":GOSUB
     910
99   1490 OL$=" JMP $C000":GOSUB
     910
32   1500 OL$=".LDERR":GOSUB 910
C9   1510 OL$=" LDA #<LDERRM":GOS
     UB 910
6E   1520 OL$=" STA TT1":GOSUB 91
     0
27   1530 OL$=" LDA #>LDERRM":GOS
     UB 910
AB   1540 OL$=" STA TT1+1":GOSUB
     910
A6   1550 OL$=" LDY #0":GOSUB 910

AD   1560 OL$=".LDERRLP":GOSUB 91
     0
C0   1570 OL$=" LDA (TT1),Y":GOSU
     B 910
ED   1580 OL$=" BEQ LDERREXIT":GO
     SUB 910
83   1590 OL$=" JSR $FFD2":GOSUB
     910
10   1600 OL$=" INY":GOSUB 910
F0   1610 OL$=" BNE LDERRLP":GOSU
     B 910
C3   1620 OL$=".LDERREXIT":GOSUB
     910
39   1630 OL$=" LDX #$80":GOSUB 9
     10
49   1640 OL$=" JMP ($0300)":GOSU
     B 910
BB   1650 OL$=";":GOSUB 910
67   1660 OL$=".SYSLIBNAME":GOSUB
     910
F7   1670 OL$=" BYT 'SYSLIB'":GOS
     UB 910
D0   1680 OL$=".LDERRM":GOSUB 910

23   1690 OL$=" BYT '[SL]IBRARY [
     SF]ILE [SN]OT [SF]OUND.',13"
     :GOSUB 910
51   1700 OL$=" BYT '[SR]UN [SA]B
     ORTED.',13,0":GOSUB 910
3A   1710 RETURN
84   1720 :
F2   1730 :
39   1740 REM ******************
     ***********
E1   1750 REM READ LINE FROM SFC
     FILE
35   1760 REM ******************
     ***********
CA   1770 :
CE   1780 OC$=""
BD   1790 INPUT#2,SL
BA   1800 FOR X=1 TO SL
89   1810 :  A$="":GET#2,A$:A$=A$
     +CHR$(0)
E3   1820 :  SF=ST
B2   1830 :  OC$=OC$+LEFT$(A$,1)
B5   1840 NEXT
CF   1850 RETURN
71   1860 :
6F   1870 :
AC   1880 REM ******************
     ***********
53   1890 REM PROCESS VARIABLE TA
     BLE
98   1900 REM ******************
     ***********
47   1910 :
15   1920 OL$="; ****** VARIABLES
     ******":GOSUB 910
D3   1930 PT%=1
CB   1940 PRINT "[SG]ENERATING [S
     V]ARIABLES."
5B   1950 IF VT%(PT%)=1 THEN OL$=
     "."+VN$(PT%)+" WOR 0":GOSUB
     910
F7   1960 IF VT%(PT%)=2 THEN OL$=
     "."+VN$(PT%)+" BYT 0,0,0":GO
     SUB 910
35   1970 IF VT%(PT%)=3 THEN GOSU
     B 2050
A6   1980 IF VT%(PT%)=4 THEN GOSU
     B 2100
88   1990 PT%=PT%+1
6F   2000 IF PT%<VT% THEN 1950
FE   2010 OL$=";":GOSUB 910
65   2020 RETURN
CF   2030 :
C5   2040 :
6C   2050 OL$="."+VN$(PT%)+" WOR"
     +STR$(VV%(PT%)):GOSUB 910
```

```
8C   2060 OL$=" RES"+STR$(2*VV%(P
     T%)):GOSUB 910
90   2070 RETURN
12   2080 :
08   2090 :
D6   2100 OL$="."+VN$(PT%)+" WOR"
     +STR$(VV%(PT%)):GOSUB 910
14   2110 OL$=" RES"+STR$(4*VV%(P
     T%)):GOSUB 910
DE   2120 RETURN
60   2130 :
5E   2140 :
BD   2150 REM ******************
     ***********
20   2160 REM PROCESS LITERALS
E9   2170 REM ******************
     ***********
B6   2180 :
C3   2190 LG=0
22   2200 PT%=1
41   2210 PRINT "[SG]ENERATING [S
     L]ITERALS."
29   2220 OL$="; ***** LITERALS *
     ****":GOSUB 910
07   2230 L$=STR$(LG):LB$="LIT"+R
     IGHT$(L$,LEN(L$)-1)
6D   2240 OL$="."+LB$+" BYT"+STR$
     (L%(PT%)):GOSUB 910
CB   2250 IF L%(PT%)>0 THEN OL$="
      BYT '"+LT$(PT%)+"'":GOSUB 9
     10
92   2260 LT$(PT%)=LB$
92   2270 PT%=PT%+1:LG=LG+1
8C   2280 IF PT%<TT% THEN 2230
39   2290 OL$=";":GOSUB 910
8A   2300 RETURN
35   2310 :
23   2320 :
48   2330 REM ******************
     ***********
CB   2340 REM PROCESS SFC FILE
44   2350 REM ******************
     ***********
7B   2360 :
59   2370 SB%=0:MR%=0:SP%=0:CS=0
07   2380 PRINT "[SG]ENERATING CO
     DE."
C5   2390 GOSUB 1780:REM READ LIN
     E FROM FILE
39   2400 GOSUB 2450:REM PROCESS
     LINE
6F   2410 IF SF=0 THEN GOTO 2390
F3   2420 RETURN
BD   2430 :
AB   2440 :
E0   2450 REM ******************
     ***********
87   2460 REM PROCESS LINE FROM S
     FC FILE
FC   2470 REM ******************
     ***********
83   2480 :
9C   2490 LP%=0
F8   2500 LP%=LP%+1
6F   2510 IF LP%>LEN(OC$) THEN RE
     TURN
E0   2520 CC%=ASC(MID$(OC$,LP%,1)
     )
88   2530 IF CC%>127 THEN 2630
CF   2540 :
90   2550 REM ***** CODES 1-33 **
     ***
30   2560 :
0E   2570 ON CC% GOSUB 2970,3100,
     3180,3260,3380,3500,3610,374
     0,3810
2F   2580 IF CC%>9 THEN ON CC%-9
     GOSUB 3890,4030,4170,2830,43
     50,4360,4390,4590,4600
D7   2590 IF CC%>18 THEN ON CC%-1
     8 GOSUB 4610,4620,4630,4640,
     4670,4670,4670,4670,4870
4C   2600 IF CC%>27 THEN ON CC%-2
     7 GOSUB 4670,4670,4980,4990,
     5000,5010
5C   2610 GOTO 2500
7C   2620 :
72   2630 REM ***** CODES 128 > *
     ****
60   2640 :
DB   2650 REM 128-138
F6   2660 ON CC%-127 GOSUB 5040,2
     830,2830,2830,2830,5170,5180
     ,5210,5320,5440,5550
C6   2670 REM 139-146
AC   2680 IF CC%>138 THEN ON CC%-
     138 GOSUB 5660,5790,5880,603
     0,6040,6070,6200,2830
D0   2690 REM 147-154
A9   2700 IF CC%>146 THEN ON CC%-
     146 GOSUB 6210,6220,2830,283
     0,6250,6430,6340,2830
8A   2710 REM 155-162
3C   2720 IF CC%>154 THEN ON CC%-
     154 GOSUB 2830,6550,6560,657
     0,6580,6590,6600,6610
18   2730 REM 163-170
84   2740 IF CC%>162 THEN ON CC%-
     162 GOSUB 6620,6630,6640,665
     0,6660,6670,6680,6690
37   2750 REM 171-178
28   2760 IF CC%>170 THEN ON CC%-
     170 GOSUB 6700,6710,6720,673
     0,6740,6750,6760,6770
A2   2770 REM 179-186
EC   2780 IF CC%>178 THEN ON CC%-
     178 GOSUB 6780,6790,6800,681
     0,6820,6830,6840,6850
39   2790 REM 187-191
31   2800 IF CC%>186 THEN ON CC%-
     186 GOSUB 6860,6870,6880,689
     0,6900
14   2810 GOTO 2500
35   2820 :
73   2830 PRINT CC%;"[SN]OT IMPLE
     MENTED"
AD   2840 RETURN
17   2850 :
0D   2860 :
EE   2870 REM ******************
     ***********
58   2880 REM GET ADDRESS FROM LI
     NE
FA   2890 REM ******************
     ***********
65   2900 :
81   2910 LP%=LP%+1:AD=ASC(MID$(O
     C$,LP%,1))
D9   2920 LP%=LP%+1:AD=AD+256*ASC
     (MID$(OC$,LP%,1))
F3   2930 RETURN
BD   2940 :
AB   2950 :
E0   2960 REM ******************
     ***********
0A   2970 REM ******************
     ***********
D3   2980 REM CODE 1. LOAD AC2 IM
     M.
06   2990 REM ******************
     ***********
F9   3000 :
D8   3010 LP%=LP%+1:LO%=ASC(MID$(
     OC$,LP%,1)):LO$=STR$(LO%)
0C   3020 LP%=LP%+1:HI%=ASC(MID$(
     OC$,LP%,1)):HI$=STR$(HI%)
C9   3030 OL$=" LDA #"+RIGHT$(LO$
     ,LEN(LO$)-1):GOSUB 910
EA   3040 OL$=" LDX #"+RIGHT$(HI$
     ,LEN(HI$)-1):GOSUB 910
B1   3050 OL$=" STA AC2":GOSUB 91
     0
98   3060 OL$=" STX AC2+1":GOSUB
     910
87   3070 RETURN
2E   3080 :
24   3090 :
B7   3100 REM ******************
     ***********
6E   3110 REM CODE 2. STACK AC2
83   3120 REM ******************
     ***********
7C   3130 :
66   3140 OL$=" LDA #$01":GOSUB 1
     040
D4   3150 RETURN
5E   3160 :
54   3170 :
C7   3180 REM ******************
     ***********
3F   3190 REM CODE 3. UNSTACK AC1
D3   3200 REM ******************
     ***********
AC   3210 :
D7   3220 OL$=" LDA #$02":GOSUB 1
     040
24   3230 RETURN
8E   3240 :
84   3250 :
17   3260 REM ******************
     ***********
01   3270 REM CODE 4. SAVE AC2 AT
      ADDR
63   3280 REM ******************
     ***********
DC   3290 :
00   3300 GOSUB 2870
55   3310 OL$=" LDA AC2":GOSUB 91
     0
18   3320 OL$=" LDX AC2+1":GOSUB
     910
FD   3330 OL$=" STA "+VN$(AD):GOS
     UB 910
86   3340 OL$=" STX "+VN$(AD)+"+1
     ":GOSUB 910
AD   3350 RETURN
17   3360 :
0D   3370 :
EE   3380 REM ******************
     ***********
0D   3390 REM CODE 5. LOAD AC2 FR
     OM ADDR
FA   3400 REM ******************
     ***********
65   3410 :
89   3420 GOSUB 2870
2C   3430 OL$=" LDA "+VN$(AD):GOS
     UB 910
93   3440 OL$=" LDX "+VN$(AD)+"+1
     ":GOSUB 910
47   3450 OL$=" STA AC2":GOSUB 91
     0
16   3460 OL$=" STX AC2+1":GOSUB
     910
15   3470 RETURN
9F   3480 :
95   3490 :
06   3500 REM ******************
     ***********
15   3510 REM CODE 6 INCREMENT IM
     MEDIATE
12   3520 REM ******************
     ***********
ED   3530 :
F1   3540 GOSUB 2870
07   3550 OL$=" INC "+VN$(AD):GOS
     UB 910
53   3560 OL$=" BNE 3":GOSUB 910
11   3570 OL$=" INC "+VN$(AD)+"+1
     ":GOSUB 910
87   3580 RETURN
2E   3590 :
24   3600 :
B7   3610 REM ******************
     ***********
E9   3620 REM CODE 7 DECREMENT IM
     MEDIATE
83   3630 REM ******************
     ***********
7C   3640 :
60   3650 GOSUB 2870
CC   3660 OL$=" DEC "+VN$(AD):GOS
     UB 910
4D   3670 OL$=" LDA "+VN$(AD):GOS
```

```
     UB 910
D5   3680 OL$=" CMP #$FF":GOSUB 9
     10
EE   3690 OL$=" BNE 3":GOSUB 910
6E   3700 OL$=" DEC "+VN$(AD)+"+1
     ":GOSUB 910
02   3710 RETURN
AC   3720 :
9A   3730 :
F1   3740 REM *******************
     ***********
02   3750 REM CODE 8  MOVE AC2 TO
      UP1
CD   3760 REM *******************
     ***********
F2   3770 :
5E   3780 OL$=" LDA #$03":GOSUB 1
     040
52   3790 RETURN
DC   3800 :
5F   3810 REM *******************
     ***********
5C   3820 REM CODE 9  MOVE AC2 TO
      UP2
AB   3830 REM *******************
     ***********
35   3840 :
D4   3850 OL$=" LDA #$04":GOSUB 1
     040
AD   3860 RETURN
17   3870 :
0D   3880 :
EE   3890 REM *******************
     ***********
FC   3900 REM CODE 10. LOAD SD2 I
     MM.
FA   3910 REM *******************
     ***********
65   3920 :
89   3930 GOSUB 2870
C8   3940 OL$=" LDA "+LT$(AD):GOS
     UB 910
CE   3950 OL$=" LDX #<"+LT$(AD)+"
     +1":GOSUB 910
41   3960 OL$=" LDY #>"+LT$(AD)+"
     +1":GOSUB 910
D6   3970 OL$=" STA SD2":GOSUB 91
     0
DF   3980 OL$=" STX SD2+1":GOSUB
     910
B5   3990 OL$=" STY SD2+2":GOSUB
     910
21   4000 RETURN
83   4010 :
F9   4020 :
12   4030 REM *******************
     ***********
5A   4040 REM CODE 11 SAVE SD2 AD
     DR
4E   4050 REM *******************
     ***********
D1   4060 :
05   4070 GOSUB 2870
BB   4080 OL$=" LDA SD2":GOSUB 91
     0
74   4090 OL$=" LDX SD2+1":GOSUB
     910
43   4100 OL$=" LDY SD2+2":GOSUB
     910
0E   4110 OL$=" STA "+VN$(AD):GOS
     UB 910
19   4120 OL$=" STX "+VN$(AD)+"+1
     ":GOSUB 910
7F   4130 OL$=" STY "+VN$(AD)+"+2
     ":GOSUB 910
B2   4140 RETURN
7C   4150 :
6A   4160 :
A1   4170 REM *******************
     ***********
5F   4180 REM CODE 12 LOAD SD2 AD
     DR
BD   4190 REM *******************
     ***********
42   4200 :
92   4210 GOSUB 2870
05   4220 OL$=" LDA "+VN$(AD):GOS
     UB 910
2A   4230 OL$=" LDX "+VN$(AD)+"+1
     ":GOSUB 910
24   4240 OL$=" LDY "+VN$(AD)+"+2
     ":GOSUB 910
D1   4250 OL$=" STA SD2":GOSUB 91
     0
3E   4260 OL$=" STX SD2+1":GOSUB
     910
C8   4270 OL$=" STY SD2+2":GOSUB
     910
46   4280 RETURN
E8   4290 :
E6   4300 :
35   4310 REM *******************
     ***********
50   4320 REM CODES 14 & 15 STACK
     /UNST SD
01   4330 REM *******************
     ***********
3E   4340 :
0C   4350 OL$=" LDA #$05":GOTO 10
     40
D6   4360 OL$=" LDA #$06":GOTO 10
     40
19   4370 :
17   4380 :
44   4390 REM *******************
     ***********
76   4400 REM CODE 16. STRING OP
     PREFIX
50   4410 REM *******************
     ***********
6F   4420 :
26   4430 LP%=LP%+1:C%=ASC(MID$(O
     C$,LP%,1))
38   4440 IF C%=164 THEN OL$=" LD
     A #$07"
F6   4450 IF C%=165 THEN OL$=" LD
     A #$08"
9C   4460 IF C%=166 THEN OL$=" LD
     A #$09"
61   4470 IF C%=167 THEN OL$=" LD
     A #$0A"
99   4480 IF C%=168 THEN OL$=" LD
     A #$0B"
45   4490 IF C%=169 THEN OL$=" LD
     A #$0C"
F6   4500 IF C%=170 THEN OL$=" LD
     A #$0D"
C7   4510 GOSUB 1040
37   4520 RETURN
F9   4530 :
F7   4540 :
24   4550 REM *******************
     ***********
5F   4560 REM CODES 17-22
30   4570 REM *******************
     ***********
CF   4580 :
17   4590 OL$=" LDA #$0E":GOTO 10
     40
F6   4600 OL$=" LDA #$0F":GOTO 10
     40
70   4610 OL$=" LDA #$10":GOTO 10
     40
2B   4620 OL$=" LDA #$11":GOTO 10
     40
0A   4630 OL$=" LDA #$12":GOTO 10
     40
75   4640 OL$=" LDA #$13":GOTO 10
     40
06   4650 :
7C   4660 :
FF   4670 REM *******************
     ***********
10   4680 REM CODES 23-26 / 28-29
CB   4690 REM *******************
     ***********
54   4700 :
97   4710 GOSUB 2880
5A   4720 OL$=" LDA #<"+VN$(AD):G
     OSUB 910
B1   4730 OL$=" LDX #>"+VN$(AD):G
     OSUB 910
59   4740 OL$=" STA TT1":GOSUB 91
     0
46   4750 OL$=" STX TT1+1":GOSUB
     910
26   4760 OL$=" LDA #$14":GOSUB 1
     040
33   4770 IF CC%<=24 OR CC%>=28 T
     HEN OL$=" LDA #$15":GOSUB 10
     40
CB   4780 IF CC%=25 OR CC%=26 THE
     N OL$=" LDA #$16":GOSUB 1040
B5   4790 IF CC%=23 THEN OL$=" LD
     A #$17":GOTO 1040
8D   4800 IF CC%=24 THEN OL$=" LD
     A #$18":GOTO 1040
71   4810 IF CC%=25 THEN OL$=" LD
     A #$19":GOTO 1040
42   4820 IF CC%=26 THEN OL$=" LD
     A #$1A":GOTO 1040
09   4830 IF CC%=28 THEN OL$=" LD
     A #$1B":GOTO 1040
3D   4840 OL$=" LDA #$1C":GOTO 10
     40
3E   4850 :
34   4860 :
A6   4870 REM *******************
     ***********
04   4880 REM CODE 27. UNSTACK AR
     RAY PTR
B2   4890 REM *******************
     ***********
0D   4900 :
59   4910 OL$=" LDA #$1D":GOTO 10
     40
71   4920 :
6F   4930 :
AC   4940 REM *******************
     ***********
E9   4950 REM CODES 30-32
98   4960 REM *******************
     ***********
47   4970 :
A4   4980 OL$=" LDA #$1E":GOTO 10
     40
8F   4990 OL$=" LDA #$1F":GOTO 10
     40
F0   5000 OL$=" LDA #$20":GOTO 10
     40
88   5010 OL$=" LDA #$4D":GOTO 10
     40
95   5020 :
83   5030 :
28   5040 REM *******************
     ***********
12   5050 REM *******************
     ***********
97   5060 REM CODE 128. END
4E   5070 REM *******************
     ***********
D1   5080 :
14   5090 IF SB% THEN SB%=0:OL$="
      RTS":GOTO 910
5B   5100 OL$=" LDA #$4E":GOTO 10
     40
33   5110 :
2E   5120 :
6D   5130 REM *******************
     ***********
D1   5140 REM CODES 133-134 BSET/
     WSET
59   5150 REM *******************
06   5160 :
02   5170 OL$=" LDA #$21":GOTO 10
     40
F9   5180 OL$=" LDA #$22":GOTO 10
     40
60   5190 :
5E   5200 :
BD   5210 REM *******************
     ***********
AF   5220 REM CODE 135. LOOP
E9   5230 REM *******************
```

```
     ***********
B6   5240 :
FF   5250 SP%=SP%+1
5B   5260 CN$=STR$(CS):CS=CS+1
E7   5270 SL$(SP%)="CTL"+RIGHT$(C
     N$,LEN(CN$)-1)
CC   5280 OL$="."+SL$(SP%):GOSUB
     910
30   5290 RETURN
F2   5300 :
E8   5310 :
63   5320 REM *******************
     ***********
33   5330 REM CODE 136. ENDLOOP
5F   5340 REM *******************
     ***********
C0   5350 :
CD   5360 CN$=SL$(SP%):SP%=SP%-1
D3   5370 NC%=ASC(MID$(OC$,LP%+1,
     1)+CHR$(0))
A1   5380 IF NC%<>0 THEN RETURN
F9   5390 OL$=" JMP "+CN$:GOSUB 9
     10
25   5400 OL$="."+CN$+"EX":GOSUB
     910
B9   5410 RETURN
7B   5420 :
71   5430 :
FA   5440 REM *******************
     ***********
9F   5450 REM CODE 137. WHILE
F6   5460 REM *******************
     ***********
49   5470 :
DB   5480 CN$=SL$(SP%)+"EX"
C7   5490 OL$=" LDA #$23":GOSUB 1
     040
C7   5500 OL$=" BNE 3":GOSUB 910
11   5510 OL$=" JMP "+CN$:GOSUB 9
     10
2B   5520 RETURN
95   5530 :
83   5540 :
28   5550 REM *******************
     ***********
03   5560 REM CODE 138. WHEN
24   5570 REM *******************
     ***********
DB   5580 :
E3   5590 OL$=" LDA #$23":GOSUB 1
     040
53   5600 OL$=" BNE 3":GOSUB 910
A5   5610 OL$=" JMP "+CN$:GOSUB 9
     10
19   5620 OL$="."+CN$+"EX":GOSUB
     910
9D   5630 RETURN
24   5640 :
12   5650 :
59   5660 REM *******************
     ***********
02   5670 REM CODE 139. IF
55   5680 REM *******************
     ***********
6A   5690 :
A3   5700 SP%=SP%+1
E5   5710 IN$=STR$(CS):CS=CS+1
AB   5720 SL$(SP%)="CTL"+RIGHT$(I
     N$,LEN(IN$)-1)
72   5730 OL$=" LDA #$23":GOSUB 1
     040
5C   5740 OL$=" BNE 3":GOSUB 910
B9   5750 OL$=" JMP "+SL$(SP%):GO
     SUB 910
18   5760 RETURN
9A   5770 :
90   5780 :
1B   5790 REM *******************
     ***********
8F   5800 REM CODE 140 . ENDIF
17   5810 REM *******************
     ***********
E8   5820 :
D4   5830 OL$=" "+SL$(SP%):GOSUB
     910
AE   5840 SP%=SP%-1
7E   5850 RETURN
C0   5860 :
3E   5870 :
1D   5880 REM *******************
     ***********
3C   5890 REM CODE 141. ELSE
48   5900 REM *******************
     ***********
17   5910 :
A8   5920 IN$=SL$(SP%)
5D   5930 SL$(SP%)=IN$+"EX"
EA   5940 OL$=" JMP "+SL$(SP%):GO
     SUB 910
EA   5950 OL$="."+IN$:GOSUB 910
D1   5960 RETURN
53   5970 :
49   5980 :
C2   5990 REM *******************
     ***********
29   6000 REM CODES 142-143 CHARO
     UT/FOPEN
3E   6010 REM *******************
     ***********
A1   6020 :
22   6030 OL$=" LDA #$24":GOTO 10
     40
51   6040 OL$=" LDA #$25":GOTO 10
     40
83   6050 :
F9   6060 :
12   6070 REM *******************
     ***********
9D   6080 REM CODE 144. BEGIN
4E   6090 REM *******************
     ***********
D1   6100 :
83   6110 IF SB% THEN RETURN
E4   6120 OL$=".MAINSTART":GOSUB
     910
87   6130 RETURN
29   6140 :
24   6150 :
B7   6160 REM *******************
     ***********
4A   6170 REM CODES 145/ 147-148
83   6180 REM *******************
     ***********
7C   6190 :
F5   6200 OL$=" LDA #$26":GOTO 10
     40
C8   6210 OL$=" LDA #$27":GOTO 10
     40
FF   6220 OL$=" LDA #$28":GOTO 10
     40
54   6230 :
42   6240 :
E9   6250 REM *******************
     ***********
D7   6260 REM CODE 151 SUBROUTINE
E5   6270 REM *******************
     ***********
9A   6280 :
0E   6290 GOSUB 2870:SB%=-1
FC   6300 OL$="."+VN$(AD):GOSUB 9
     10
30   6310 RETURN
F2   6320 :
E8   6330 :
63   6340 REM *******************
     ***********
C5   6350 REM CODE 153. CALL
5F   6360 REM *******************
     ***********
C0   6370 :
14   6380 GOSUB 2870
8B   6390 OL$=" JSR "+VN$(AD):GOS
     UB 910
97   6400 RETURN
19   6410 :
17   6420 :
44   6430 REM *******************
     ***********
73   6440 REM CODE 152. RETURN
50   6450 REM *******************
     ***********
6F   6460 :
8A   6470 OL$=" RTS":GOSUB 910
E7   6480 RETURN
49   6490 :
47   6500 :
94   6510 REM *******************
     ***********
56   6520 REM CODES 156-191
E0   6530 REM *******************
     ***********
9F   6540 :
6D   6550 OL$=" LDA #$29":GOTO 10
     40
CB   6560 OL$=" LDA #$2A":GOTO 10
     40
FE   6570 OL$=" LDA #$2B":GOTO 10
     40
45   6580 OL$=" LDA #$2C":GOTO 10
     40
98   6590 OL$=" LDA #$2D":GOTO 10
     40
3F   6600 OL$=" LDA #$2E":GOTO 10
     40
B2   6610 OL$=" LDA #$2F":GOTO 10
     40
97   6620 OL$=" LDA #$30":GOTO 10
     40
4A   6630 OL$=" LDA #$31":GOTO 10
     40
21   6640 OL$=" LDA #$32":GOTO 10
     40
14   6650 OL$=" LDA #$33":GOTO 10
     40
20   6660 OL$=" LDA #$34":GOTO 10
     40
07   6670 OL$=" LDA #$35":GOTO 10
     40
7A   6680 OL$=" LDA #$36":GOTO 10
     40
01   6690 OL$=" LDA #$37":GOTO 10
     40
14   6700 OL$=" LDA #$38":GOTO 10
     40
FB   6710 OL$=" LDA #$39":GOTO 10
     40
C1   6720 OL$=" LDA #$3A":GOTO 10
     40
CC   6730 OL$=" LDA #$3B":GOTO 10
     40
AB   6740 OL$=" LDA #$3C":GOTO 10
     40
06   6750 OL$=" LDA #$3D":GOTO 10
     40
35   6760 OL$=" LDA #$3E":GOTO 10
     40
80   6770 OL$=" LDA #$3F":GOTO 10
     40
37   6780 OL$=" LDA #$40":GOTO 10
     40
D6   6790 OL$=" LDA #$41":GOTO 10
     40
B9   6800 OL$=" LDA #$42":GOTO 10
     40
E8   6810 OL$=" LDA #$43":GOTO 10
     40
8B   6820 OL$=" LDA #$44":GOTO 10
     40
6A   6830 OL$=" LDA #$45":GOTO 10
     40
2D   6840 OL$=" LDA #$46":GOTO 10
     40
FC   6850 OL$=" LDA #$47":GOTO 10
     40
7F   6860 OL$=" LDA #$48":GOTO 10
     40
DE   6870 OL$=" LDA #$49":GOTO 10
     40
38   6880 OL$=" LDA #$4A":GOTO 10
     40
13   6890 OL$=" LDA #$4B":GOTO 10
     40
0A   6900 OL$=" LDA #$4C":GOTO 10
     40
```

Listings

PROGRAM: ASSEMBLE.LDR

```
D9   10 IF PEEK(44)=8 THEN PRINT
     "CHANGE START OF BASIC FIRST
     !!":END
AF   15 AD=2049
E3   20 FOR LN=100 TO 2430 STEP 1
     0
A3   25 :  RT=0
91   30 :  FOR OS=0 TO 15
C2   35 :     READ BY:POKE AD+OS,
     BY
4D   40 :     RT=RT+BY
99   45 :  NEXT
DC   50 :  READ TT:IF TT<>RT THEN
      PRINT "ERROR IN LINE";LN:EN
     D
2A   55 :  AD=AD+16
BE   60 NEXT
FE   65 PRINT "SAVING 'ASSEMBLE'"

33   70 HI=INT(AD/256):LO=AD-HI*2
     56
1E   75 POKE 43,1:POKE 44,8:POKE
     45,LO:POKE 46,HI:SAVE"ASSEMB
     LE",8
CC   80 CLR
6F   85 :
60   90 :
61   100 DATA 12,8,10,0,158,32,50
     ,48,54,51,0,0,0,0,76,33, 532
85   110 DATA 22,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0, 22
2B   120 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
F1   130 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
FF   140 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
05   150 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
53   160 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
59   170 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
67   180 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
6D   190 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
3B   200 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
41   210 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
4F   220 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
95   230 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
A3   240 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
A9   250 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
76   260 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
7C   270 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
8A   280 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0, 0
03   290 DATA 0,0,0,0,0,46,69,88,
     69,44,80,44,87,46,65,83, 721

A2   300 DATA 77,64,48,58,13,197,
     78,84,69,82,32,198,73,76,69,
     78, 1296
70   310 DATA 65,77,69,32,40,46,6
     5,83,77,41,58,0,13,206,79,32
     , 983
C7   320 DATA 70,73,76,69,78,65,7
     7,69,32,71,73,86,69,78,59,32
     , 1077
E0   330 DATA 193,66,79,82,84,73,
     78,71,13,0,13,198,73,76,69,7
     8, 1246
8F   340 DATA 65,77,69,32,84,79,7
     9,32,76,79,78,71,59,32,208,7
     6, 1196
FF   350 DATA 69,65,83,69,32,212,
     82,89,32,65,71,65,73,78,13,0
     , 1098
F9   360 DATA 14,147,13,198,195,2
     04,32,193,83,83,69,77,66,76,
     69,82, 1601
88   370 DATA 46,13,214,69,82,83,
     73,79,78,32,49,46,49,47,56,5
     6, 1072
9F   380 DATA 13,211,84,69,86,69,
     32,195,65,82,82,73,69,32,49,
     57, 1268
91   390 DATA 56,56,13,0,13,13,19
     3,83,83,69,77,66,76,69,82,32
     , 981
33   400 DATA 208,65,83,83,32,0,3
     2,66,69,71,73,78,83,46,13,0,
      1002
30   410 DATA 13,193,83,83,69,77,
     66,76,89,32,67,79,77,80,76,6
     9, 1229
34   420 DATA 84,69,46,13,204,79,
     65,68,32,65,68,68,82,69,83,8
     3, 1178
C7   430 DATA 32,61,36,0,13,197,7
     8,68,32,65,68,68,82,69,83,83
     , 1035
92   440 DATA 32,32,61,36,0,66,82
     ,75,0,67,76,67,24,67,76,68,
     829
B7   450 DATA 216,67,76,73,88,67,
     76,86,184,68,69,88,202,68,69
     ,89, 1586
BA   460 DATA 136,73,78,88,232,73
     ,78,89,200,78,79,80,234,80,7
     2,65, 1735
6D   470 DATA 72,80,72,80,8,80,76
     ,65,104,80,76,80,40,82,84,73
     , 1152
30   480 DATA 64,82,84,83,96,83,6
     9,67,56,83,69,68,248,83,69,7
     3, 1377
25   490 DATA 120,84,65,88,170,84
     ,65,89,168,84,83,88,186,84,8
     8,65, 1611
A1   500 DATA 138,84,88,83,154,84
     ,89,65,152,66,67,67,144,66,6
     7,83, 1497
CB   510 DATA 176,66,69,81,240,66
     ,77,73,48,66,78,69,208,66,80
     ,76, 1539
E3   520 DATA 16,66,86,67,80,66,8
     6,83,112,65,68,67,0,65,78,68
     , 1073
68   530 DATA 11,65,83,76,22,66,7
     3,84,33,67,77,80,44,67,80,88
     , 1016
BB   540 DATA 55,67,80,89,66,68,6
     9,67,77,69,79,82,88,73,78,67
     , 1174
8B   550 DATA 99,74,77,80,110,74,
     83,82,121,76,68,65,132,76,68
     ,88, 1373
FF   560 DATA 143,76,68,89,154,76
     ,83,82,165,79,82,65,176,82,7
     9,76, 1575
29   570 DATA 187,82,79,82,198,83
     ,66,67,209,83,84,65,220,83,8
     4,88, 1760
EE   580 DATA 231,83,84,89,242,66
     ,89,84,0,87,79,82,1,69,81,90
     , 1457
E5   590 DATA 2,69,81,65,3,79,82,
     71,4,82,69,83,5,255,105,101,
      1156
6B   600 DATA 117,255,109,125,121
     ,97,113,255,255,41,37,53,255
     ,45,61,57, 1996
87   610 DATA 33,49,255,10,255,6,
     22,255,14,30,255,255,255,255
     ,255,255, 2459
32   620 DATA 36,255,255,44,255,2
     55,255,255,255,255,201,197,2
     13,255,205,221, 3412
6F   630 DATA 217,193,209,255,255
     ,224,228,255,255,236,255,255
     ,255,255,255,255, 3857
22   640 DATA 192,196,255,255,204
     ,255,255,255,255,255,255,255
     ,198,214,255,206, 3760
EA   650 DATA 222,255,255,255,255
     ,255,73,69,85,255,77,93,89,6
     5,81,255, 2639
D0   660 DATA 255,255,230,246,255
     ,238,254,255,255,255,255,255
     ,255,255,255,255, 4028
F2   670 DATA 76,255,255,255,255,
     108,255,255,255,255,255,32,2
     55,255,255,255, 3531
07   680 DATA 255,255,169,165,181
     ,255,173,189,185,161,177,255
     ,255,162,166,255, 3258
B0   690 DATA 182,174,255,190,255
     ,255,255,255,160,164,180,255
     ,172,188,255,255, 3450
18   700 DATA 255,255,74,255,70,8
     6,255,78,94,255,255,255,255,
     255,9,5, 2711
FB   710 DATA 21,255,13,29,25,1,1
     7,255,42,255,38,54,255,46,62
     ,255, 1623
CB   720 DATA 255,255,255,106,255
     ,102,118,255,110,126,255,255
     ,255,255,255,233, 3345
11   730 DATA 229,245,255,237,253
     ,249,225,241,255,255,255,133
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    ,149,255,141,157, 3534
47  740 DATA 153,129,145,255,255
    ,255,134,255,150,142,255,255
    ,255,255,255,255, 3403
AC  750 DATA 255,132,148,255,140
    ,255,255,255,255,255,255,255
    ,255,13,193,83, 3259
DE  760 DATA 83,69,77,66,76,89,3
    2,70,65,73,76,83,32,79,78,32
    , 1080
72  770 DATA 84,72,73,83,32,76,7
    3,78,69,0,213,78,68,69,70,73
    , 1211
BB  780 DATA 78,69,68,32,211,89,
    77,66,79,76,32,197,82,82,79,
    82, 1399
C0  790 DATA 0,210,69,68,69,70,7
    3,78,69,68,32,211,89,77,66,7
    9, 1328
CD  800 DATA 76,32,197,82,82,79,
    82,0,205,78,69,77,79,78,73,6
    7, 1356
9F  810 DATA 32,78,79,84,32,82,6
    9,67,79,71,78,73,83,69,68,0,
     1044
27  820 DATA 194,65,68,32,211,89
    ,77,66,79,76,32,69,82,82,79,
    82, 1383
7F  830 DATA 0,201,76,76,69,71,6
    5,76,32,207,80,69,82,65,78,6
    8, 1315
72  840 DATA 32,198,73,69,76,68,
    0,201,76,76,69,71,65,76,32,2
    05, 1387
F6  850 DATA 78,69,77,79,78,73,6
    7,32,198,73,69,76,68,0,205,7
    3, 1315
2C  860 DATA 83,83,73,78,71,32,2
    07,80,69,82,65,78,68,32,197,
    82, 1380
34  870 DATA 82,79,82,46,0,196,7
    3,83,75,32,198,73,76,69,32,1
    97, 1393
D6  880 DATA 82,82,79,82,46,0,21
    1,89,78,84,65,88,32,69,82,82
    , 1251
56  890 DATA 79,82,46,0,201,76,7
    6,69,71,65,76,32,209,85,65,7
    8, 1310
17  900 DATA 84,73,84,89,32,197,
    82,82,79,82,0,201,76,76,69,7
    1, 1377
EB  910 DATA 65,76,32,193,68,68,
    82,69,83,83,73,78,71,32,77,7
    9, 1229
D7  920 DATA 68,69,46,0,206,79,8
    4,32,216,32,79,82,32,217,32,
    73, 1347
6D  930 DATA 78,68,69,88,46,0,21
    1,89,77,66,79,76,32,84,65,66
    , 1194
24  940 DATA 76,69,32,70,85,76,7
    6,46,0,194,82,65,78,67,72,32
    , 1120
FD  950 DATA 210,65,78,71,69,32,
    69,82,82,79,82,46,0,30,12,59
    , 1066
8A  960 DATA 12,82,12,105,12,129
    ,12,146,12,168,12,191,12,214
    ,12,231, 1362
4E  970 DATA 12,245,12,12,13,37,
    13,55,13,74,13,169,38,162,10
    ,133, 1011
7F  980 DATA 20,134,21,162,0,160
    ,2,185,231,8,209,20,208,9,13
    6,16, 1521
56  990 DATA 246,160,3,177,20,24
    ,96,232,224,62,176,250,165,2
    0,105,4, 1964
96  1000 DATA 133,20,165,21,105,
    0,133,21,24,144,218,173,230,
    8,201,3, 1599
5A  1010 DATA 240,5,162,3,76,190
    ,13,32,124,13,176,246,96,138
    ,10,72, 1596
93  1020 DATA 173,23,8,201,1,208
    ,8,32,78,14,169,13,32,210,25
    5,104, 1529
D9  1030 DATA 170,142,19,8,189,9
    5,13,168,189,94,13,170,32,25
    5,13,173, 1743
01  1040 DATA 19,8,240,5,169,0,7
    6,209,13,169,2,32,195,255,16
    9,3, 1564
E7  1050 DATA 32,195,255,174,18,
    8,232,232,154,162,128,108,0,
    3,134,20, 1855
A4  1060 DATA 132,21,160,0,177,2
    0,240,6,32,210,255,200,208,2
    46,96,201, 2204
DF  1070 DATA 65,144,6,201,91,17
    6,2,56,96,24,96,201,48,144,2
    50,201, 1801
7E  1080 DATA 58,176,246,144,242
    ,32,16,14,176,237,76,28,14,3
    2,28,14, 1533
68  1090 DATA 176,229,201,65,144
    ,227,201,71,176,223,144,219,
    134,20,132,21, 2383
B2  1100 DATA 160,0,177,20,32,21
    0,255,200,201,13,208,246,96,
    162,88,160, 2178
A4  1110 DATA 8,76,61,14,201,10,
    176,3,9,48,96,105,54,96,72,7
    4, 1103
2E  1120 DATA 74,74,74,32,85,14,
    32,210,255,104,41,15,32,85,1
    4,76, 1217
3D  1130 DATA 210,255,165,72,32,
    95,14,165,71,76,95,14,32,115
    ,14,169, 1594
92  1140 DATA 32,32,210,255,76,7
    8,14,169,38,162,8,133,20,134
    ,21,162, 1544
B6  1150 DATA 2,32,198,255,32,22
    8,255,141,34,8,32,228,255,14
    1,35,8, 1884
5A  1160 DATA 208,10,173,34,8,20
    8,5,32,204,255,56,96,32,228,
    255,141, 1945
98  1170 DATA 36,8,32,228,255,14
    1,37,8,32,228,255,201,0,240,
    13,160, 1874
F9  1180 DATA 0,145,20,230,20,20
    8,241,230,21,76,185,14,169,1
    3,145,20, 1737
2D  1190 DATA 24,96,173,24,8,240
    ,1,96,162,9,76,190,13,169,0,
    133, 1414
F0  1200 DATA 71,133,72,165,45,1
    66,46,133,69,134,70,160,0,15
    2,145,69, 1630
AC  1210 DATA 162,161,160,9,32,2
    55,13,96,169,0,141,230,8,160
    ,0,32, 1628
6A  1220 DATA 207,255,201,13,240
    ,6,153,231,8,200,208,243,140
    ,230,8,96, 2439
27  1230 DATA 162,69,160,9,32,25
    5,13,32,249,14,173,230,8,208
    ,10,162, 1786
01  1240 DATA 93,160,9,32,255,13
    ,76,234,13,201,13,144,10,162
    ,123,160, 1698
6C  1250 DATA 9,32,255,13,76,17,
    15,160,0,185,66,9,153,198,8,
    200, 1396
F7  1260 DATA 192,3,208,245,162,
    0,189,231,8,157,166,8,153,19
    8,8,232, 2160
12  1270 DATA 200,236,230,8,208,
    240,162,0,189,54,9,153,198,8
    ,232,200, 2327
B1  1280 DATA 224,8,208,244,140,
    33,8,174,230,8,160,0,185,62,
    9,157, 1850
B5  1290 DATA 166,8,200,232,192,
    4,208,244,142,32,8,96,169,2,
    168,162, 2033
61  1300 DATA 8,32,186,255,173,3
    2,8,162,166,160,8,32,189,255
    ,32,192, 1890
C0  1310 DATA 255,176,83,162,2,3
    2,198,255,176,76,32,228,255,
    32,183,255, 2400
1B  1320 DATA 208,68,32,228,255,
    32,183,255,208,60,32,204,255
    ,96,169,3, 2288
43  1330 DATA 168,162,8,32,186,2
    55,173,33,8,162,198,160,8,32
    ,189,255, 2029
B0  1340 DATA 32,192,255,176,33,
    162,3,32,201,255,176,26,173,
    30,8,32, 1786
41  1350 DATA 210,255,32,183,255
    ,208,15,173,31,8,32,210,255,
    32,183,255, 2337
1B  1360 DATA 208,4,32,204,255,9
    6,32,204,255,169,16,76,209,1
    3,173,23, 1969
68  1370 DATA 8,9,48,141,230,9,1
    62,213,160,9,76,255,13,230,2
    51,208, 2022
CB  1380 DATA 2,230,252,140,19,8
    ,160,0,177,251,172,19,8,96,1
    98,251, 1983
C8  1390 DATA 165,251,201,255,20
    8,2,198,252,96,32,15,16,169,
    0,170,141, 2171
1C  1400 DATA 230,8,32,254,15,32
    ,38,14,176,4,142,230,8,96,15
    7,231, 1667
89  1410 DATA 8,232,208,238,32,2
    54,15,32,4,16,201,32,240,246
    ,96,165, 2019
95  1420 DATA 45,166,46,133,5,13
    4,6,160,0,177,5,208,2,24,96,
    205, 1412
54  1430 DATA 230,8,208,40,162,0
    ,200,200,200,200,177,5,221,2
    31,8,208, 2298
9D  1440 DATA 27,232,236,230,8,1
    44,242,160,1,177,5,141,22,8,
    200,177, 2010
4E  1450 DATA 5,141,20,8,200,177
    ,5,141,21,8,56,96,160,0,177,
    5, 1220
26  1460 DATA 24,105,4,101,5,133
    ,5,144,2,230,6,76,72,16,32,2
    54, 1209
D4  1470 DATA 15,32,26,16,173,23
    0,8,208,5,162,4,76,190,13,32
    ,64, 1254
AC  1480 DATA 16,144,12,162,2,17
    3,23,8,201,1,208,5,76,190,13
    ,162, 1396
5D  1490 DATA 0,169,1,141,24,8,2
    24,0,240,1,96,160,0,173,230,
    8, 1475
8C  1500 DATA 145,69,200,169,2,1
    45,69,200,165,71,145,69,200,
    165,72,145, 2031
30  1510 DATA 69,200,162,0,189,2
    31,8,145,69,232,200,236,230,
    8,208,244, 2431
D3  1520 DATA 152,24,101,69,133,
    69,165,70,105,0,133,70,201,1
    60,208,5, 1665
EB  1530 DATA 162,13,76,190,13,1
    60,0,152,145,69,96,169,0,133
    ,3,133, 1514
2B  1540 DATA 4,32,254,15,32,46,
    14,176,1,96,201,65,176,4,41,
    15, 1172
82  1550 DATA 144,2,233,55,24,6,
    3,38,4,176,25,6,3,38,4,176,
    937
F4  1560 DATA 19,6,3,38,4,176,13
    ,6,3,38,4,176,7,5,3,133, 634
C4  1570 DATA 3,76,2,17,162,10,7
    6,190,13,169,0,133,3,133,4,3
    2, 1023
D4  1580 DATA 15,16,32,254,15,32
    ,28,14,176,1,96,41,15,72,165
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    ,4, 976
FB  1590 DATA 72,165,3,72,6,3,38
    ,4,176,218,6,3,38,4,176,212,
    1196
6D  1600 DATA 24,104,101,3,133,3
    ,104,105,0,133,4,176,199,6,3
    ,38, 1136
21  1610 DATA 4,176,193,104,24,1
    01,3,133,3,165,4,105,0,133,4
    ,176, 1328
A0  1620 DATA 179,144,191,32,254
    ,15,133,3,169,0,133,4,32,254
    ,15,201, 1759
66  1630 DATA 39,240,5,162,8,76,
    190,13,76,254,15,76,179,17,1
    73,25, 1548
A7  1640 DATA 8,240,36,201,60,24
    0,4,165,4,133,3,169,0,133,4,
    76, 1476
72  1650 DATA 200,17,32,4,16,201
    ,13,240,229,201,40,240,225,2
    01,41,240, 2140
DE  1660 DATA 221,201,44,240,217
    ,208,15,169,1,141,27,8,165,4
    ,240,5, 1906
51  1670 DATA 169,2,141,27,8,96,
    201,43,240,4,201,45,208,72,1
    73,26, 1656
14  1680 DATA 8,240,5,162,9,76,1
    90,13,238,26,8,165,4,72,165,
    3, 1384
12  1690 DATA 72,32,4,16,72,32,2
    54,15,32,156,17,104,201,43,2
    40,24, 1314
B0  1700 DATA 166,3,164,4,104,13
    3,3,104,133,4,56,138,229,3,1
    33,3, 1380
E3  1710 DATA 152,229,4,133,4,76
    ,156,17,24,104,101,3,133,3,1
    04,101, 1344
75  1720 DATA 4,133,4,76,156,17,
    162,0,142,26,8,201,60,240,4,
    201, 1434
0A  1730 DATA 62,208,6,141,25,8,
    32,254,15,201,39,208,6,32,13
    2,17, 1386
C9  1740 DATA 76,156,17,32,16,14
    ,144,54,32,26,16,32,64,16,17
    6,25, 896
C6  1750 DATA 169,1,141,28,8,173
    ,23,8,201,2,208,5,162,1,76,1
    90, 1396
BA  1760 DATA 13,169,2,141,27,8,
    76,156,17,169,0,173,20,8,133
    ,3, 1115
4A  1770 DATA 173,21,8,133,4,173
    ,22,8,141,27,8,76,156,17,201
    ,36, 1204
55  1780 DATA 240,4,201,38,208,6
    ,32,252,16,76,156,17,32,28,1
    4,144, 1464
EA  1790 DATA 6,32,58,17,76,156,
    17,162,5,76,190,13,173,27,8,
    24, 1040
A4  1800 DATA 105,1,24,101,71,13
    3,71,169,0,101,72,133,72,173
    ,23,8, 1257
03  1810 DATA 201,2,240,1,96,162
    ,3,32,201,255,173,29,8,32,21
    0,255, 1900
7B  1820 DATA 32,183,255,240,3,7
    6,231,15,172,27,8,240,29,165
    ,3,32, 1711
F0  1830 DATA 210,255,32,183,255
    ,240,3,76,231,15,136,240,13,
    165,4,32, 2090
24  1840 DATA 210,255,32,183,255
    ,240,3,76,231,15,76,204,255,
    141,29,8, 2213
60  1850 DATA 169,0,141,27,8,76,
    157,18,141,29,8,32,156,17,17
    3,23, 1175
D6  1860 DATA 8,201,1,240,58,173
    ,27,8,201,1,240,51,165,71,24
    ,105, 1574
6B  1870 DATA 2,170,165,72,105,0
    ,168,165,3,134,3,166,4,132,4
    ,56, 1349
5F  1880 DATA 229,3,133,3,138,22
    9,4,133,4,201,255,240,12,201
    ,0,208, 1993
4A  1890 DATA 22,165,3,201,127,1
    76,16,144,6,165,3,201,128,14
    4,8,169, 1678
DB  1900 DATA 1,141,27,8,76,157,
    18,162,14,76,190,13,141,29,8
    ,24, 1085
FE  1910 DATA 105,30,133,253,169
    ,11,105,0,133,254,32,4,16,20
    1,65,208, 1719
D7  1920 DATA 24,160,1,177,251,2
    01,13,240,4,201,32,208,12,32
    ,254,15, 1825
A2  1930 DATA 169,0,141,27,8,168
    ,76,105,20,32,4,16,201,35,20
    8,33, 1243
55  1940 DATA 32,254,15,32,156,1
    7,173,28,8,240,5,169,1,141,2
    7,8, 1306
3C  1950 DATA 173,27,8,201,1,240
    ,5,162,10,76,190,13,160,1,76
    ,105, 1448
23  1960 DATA 20,201,40,240,81,3
    2,156,17,173,28,8,240,5,169,
    2,141, 1553
09  1970 DATA 27,8,173,27,8,201,
    1,208,2,160,2,201,2,208,2,16
    0, 1390
A5  1980 DATA 5,173,29,8,201,110
    ,240,4,201,121,208,2,160,5,1
    92,5, 1664
47  1990 DATA 208,5,169,2,141,27
    ,8,32,4,16,201,44,240,3,76,1
    05, 1281
4F  2000 DATA 20,32,254,15,201,8
    8,240,10,201,89,240,5,162,12
    ,76,190, 1835
FD  2010 DATA 13,200,200,76,105,
    20,32,254,15,32,156,17,32,4,
    16,201, 1373
8F  2020 DATA 41,240,53,173,28,8
    ,240,5,169,1,141,27,8,173,27
    ,8, 1342
1D  2030 DATA 201,1,240,5,162,10
    ,76,190,13,32,4,16,201,44,24
    0,5, 1440
E4  2040 DATA 162,9,76,190,13,32
    ,254,15,201,88,208,244,32,25
    4,15,201, 1994
DF  2050 DATA 41,208,237,160,8,7
    6,105,20,32,254,15,201,44,24
    0,10,169, 1820
78  2060 DATA 2,141,27,8,160,10,
    76,105,20,173,28,8,240,5,169
    ,1, 1173
34  2070 DATA 141,27,8,173,27,8,
    201,1,240,5,162,10,76,190,13
    ,32, 1314
96  2080 DATA 254,15,201,89,208,
    186,160,9,177,253,201,255,24
    0,6,141,29, 2424
93  2090 DATA 8,76,157,18,162,11
    ,76,190,13,224,56,144,3,76,2
    46,20, 1480
FA  2100 DATA 224,33,144,3,76,77
    ,19,224,25,144,3,76,249,18,7
    6,238, 1629
10  2110 DATA 18,169,0,133,71,13
    3,72,32,239,15,32,136,14,8,1
    69,38, 1279
74  2120 DATA 162,8,133,251,134,
    252,32,15,16,40,144,1,96,173
    ,23,8, 1488
79  2130 DATA 201,2,208,3,32,125
    ,14,169,0,141,24,8,141,25,8,
    141, 1242
80  2140 DATA 26,8,141,28,8,32,5
    3,16,201,59,240,206,201,46,2
    08,6, 1479
9A  2150 DATA 32,143,16,32,56,16
    ,201,13,240,192,32,16,14,176
    ,5,162, 1346
1D  2160 DATA 6,76,190,13,32,26,
    16,32,172,13,72,32,56,16,104
    ,32, 888
16  2170 DATA 122,20,76,155,20,2
    24,56,208,3,76,106,21,224,57
    ,208,3, 1579
0E  2180 DATA 76,181,21,224,58,2
    08,3,76,220,21,224,59,208,3,
    76,8, 1666
A9  2190 DATA 22,224,60,208,3,76
    ,82,21,32,56,16,32,156,17,16
    5,3, 1173
63  2200 DATA 24,101,71,133,71,1
    65,4,101,72,133,72,173,23,8,
    201,2, 1354
C2  2210 DATA 240,1,96,162,3,32,
    201,255,169,0,166,3,164,4,20
    2,224, 1922
3E  2220 DATA 255,208,8,136,192,
    255,208,3,76,204,255,32,210,
    255,76,63, 2436
4B  2230 DATA 21,32,56,16,32,156
    ,17,165,3,166,4,133,71,134,7
    2,141, 1219
D1  2240 DATA 30,8,142,31,8,96,3
    2,53,16,32,56,16,201,39,240,
    38, 1038
0F  2250 DATA 32,156,17,165,4,24
    0,5,162,10,76,190,13,32,111,
    22,230, 1465
E7  2260 DATA 71,208,2,230,72,32
    ,56,16,201,44,240,218,201,13
    ,208,1, 1813
5F  2270 DATA 96,162,9,76,190,13
    ,32,254,15,201,39,240,14,133
    ,3,32, 1509
8C  2280 DATA 111,22,230,71,208,
    2,230,72,76,151,21,32,254,15
    ,76,134, 1705
40  2290 DATA 21,32,53,16,32,56,
    16,32,156,17,32,119,22,165,7
    1,24, 864
0F  2300 DATA 105,2,133,71,165,7
    2,105,0,133,72,32,56,16,201,
    44,240, 1447
D8  2310 DATA 224,201,13,208,1,9
    6,162,9,76,190,13,32,211,14,
    165,6, 1621
2C  2320 DATA 72,165,5,72,32,156
    ,17,104,133,5,104,133,6,165,
    4,240, 1413
1B  2330 DATA 5,162,10,76,190,13
    ,160,1,169,1,145,5,200,165,3
    ,145, 1450
22  2340 DATA 5,200,165,4,145,5,
    96,32,211,14,165,5,72,165,6,
    72, 1362
61  2350 DATA 32,156,17,104,133,
    6,104,133,5,160,1,169,2,76,2
    51,21, 1370
60  2360 DATA 186,142,18,8,32,22
    2,14,32,17,15,169,1,141,23,8
    ,32, 1060
05  2370 DATA 125,15,32,146,20,1
    69,2,32,195,255,238,23,8,32,
    125,15, 1432
B2  2380 DATA 32,175,15,32,146,2
    0,32,77,22,76,234,13,162,241
    ,160,9, 1446
F8  2390 DATA 32,255,13,173,31,8
    ,32,95,14,173,30,8,32,95,14,
    162, 1167
A1  2400 DATA 21,160,10,32,255,1
    3,32,115,14,169,13,76,210,25
    5,169,1, 1545
8A  2410 DATA 141,27,8,76,124,22
    ,169,2,141,27,8,173,23,8,201
    ,2, 1152
2B  2420 DATA 240,1,96,162,3,32,
    201,255,172,27,8,165,3,32,21
    0,255, 1862
AA  2430 DATA 136,240,5,165,4,32
    ,210,255,76,204,255,0,0,0,0,
    0, 1582
```

MAY I INTERRUPT

```
PROGRAM: MAY I INTERRUPT
DB  10 BL=209   :LN=50    :SA=4915
    2
C0  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A
82  25 POKE53280,A:POKE SA+L*16+
    D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
1D  40 NEXT L:SYS52480
84  50 DATA 0,0,0,0,0,21,21,21,2
    1,21,21,21,21,23,23,23,237
D6  60 DATA 23,23,23,23,23,25,25
    ,25,25,25,25,25,25,19,19,19,
    372
40  70 DATA 19,19,19,19,19,21,21
    ,21,21,21,21,21,21,23,23,23,
    332
9A  80 DATA 23,23,23,23,23,25,25
    ,25,25,25,25,25,25,19,19,19,
    372
DD  90 DATA 19,19,19,19,19,100,1
    00,84,84,100,100,100,100,94,
    94,94,1145
CB  100 DATA 94,79,79,79,79,84,8
    4,84,84,75,75,75,75,75,75,75
    ,1271
E3  110 DATA 75,71,71,71,71,71,7
    1,71,71,67,67,67,67,67,67,67
    ,1112
07  120 DATA 67,63,63,84,84,67,6
    7,84,84,63,63,63,63,63,63,63
    ,1104
5F  130 DATA 63,63,63,63,63,50,5
    0,42,42,50,50,50,50,47,47,47
    ,840
99  140 DATA 47,67,67,67,67,63,6
    3,63,63,100,100,100,100,100,
    100,100,1267
E9  150 DATA 100,94,94,94,94,94,
    94,94,94,84,84,84,84,84,84,8
    4,1440
77  160 DATA 84,79,79,94,94,84,8
    4,94,94,79,79,79,79,79,79,79
    ,1339
8A  170 DATA 79,79,79,79,79,100,
    100,84,84,100,100,100,100,94
    ,94,94,1445
5B  180 DATA 94,79,79,79,79,84,8
    4,84,84,75,75,75,75,75,75,75
    ,1271
33  190 DATA 75,71,71,71,71,71,7
    1,71,71,67,67,67,67,67,67,67
    ,1112
D7  200 DATA 67,63,63,84,84,67,6
    7,84,84,63,63,63,63,63,63,63
    ,1104
78  210 DATA 63,63,63,63,63,42,4
    2,35,35,42,42,42,42,39,39,39
    ,754
3E  220 DATA 39,39,39,39,39,37,3
    7,31,31,37,37,37,37,35,35,35
    ,584
5E  230 DATA 35,35,35,35,35,33,3
    3,28,28,33,33,33,33,31,31,31
    .522
F1  240 DATA 31,31,31,31,31,31,3
    9,47,63,84,84,84,84,84,84,84
    ,923
5B  250 DATA 84,84,84,84,84,0,0,
    0,0,0,0,0,0,0,0,0,420
33  260 DATA 0,0,0,0,0,31,31,31,
    31,31,31,31,31,181,181,181,7
    91
39  270 DATA 181,181,181,181,181
    ,30,30,30,30,30,30,30,30,239
    ,239,239,1862
32  280 DATA 239,239,239,239,239
    .31,31,31,31,31,31,31,31,181
    ,181,181,1986
95  290 DATA 181,181,181,181,181
    ,30,30,30,30,30,30,30,30,239
    ,239,239,1862
59  300 DATA 239,239,239,239,239
    ,121,121,125,125,121,121,121
    ,121,215,215,215,2816
03  310 DATA 215,191,191,191,191
    ,125,125,125,125,69,69,69,69
    ,69,69,69,1962
8A  320 DATA 69,12,12,12,12,12,1
    2,12,12,15,15,15,15,15,15,15
    ,270
33  330 DATA 15,75,75,125,125,15
    ,15,125,125,75,75,75,75,75,7
    5,75,1220
DE  340 DATA 75,75,75,75,75,60,6
    0,62,62,60,60,60,60,107,107,
    107,1180
FD  350 DATA 107,15,15,15,15,75,
    75,75,75,121,121,121,121,121
    ,121,121,1314
60  360 DATA 121,215,215,215,215
    ,215,215,215,215,125,125,125
    ,125,125,125,125,2716
61  370 DATA 125,191,191,215,215
    ,125,125,215,215,191,191,191
    ,191,191,191,191,2954
91  380 DATA 191,191,191,191,191
    ,121,121,125,125,121,121,121
    ,121,215,215,215,2576
83  390 DATA 215,191,191,191,191
    ,125,125,125,125,69,69,69,69
    ,69,69,69,1962
4A  400 DATA 69,12,12,12,12,12,1
    2,12,12,15,15,15,15,15,15,15
    ,270
43  410 DATA 15,75,75,125,125,15
    ,15,125,125,75,75,75,75,75,7
    5,75,1220
62  420 DATA 75,75,75,75,75,62,6
    2,134,134,62,62,62;62,223,22
    3,223,1684
0B  430 DATA 223,223,223,223,223
    ,162,162,165,165,162,162,162
    ,162,134,134,134,2819
0A  440 DATA 134,134,134,134,134
    ,135,135,49,49,135,135,135,1
    35,165,165,165,2073
52  450 DATA 165,165,165,165,165
    ,165,223,107,75,125,125,125,
    125,125,125,125,2270
49  460 DATA 125,125,125,125,125
    ,0,0,0,0,0,0,0,0,0,0,0,625
63  470 DATA 0,0,0,0,0,17,17,17,
    16,0,0,0,0,17,17,17,118
88  480 DATA 16,0,0,0,0,17,17,17
    ,16,0,0,0,0,17,17,17,134
16  490 DATA 16,0,0,0,0,17,17,17
    ,16,0,0,0,0,17,17,17,134
84  500 DATA 16,0,0,0,0,17,17,17
    ,16,0,0,0,0,17,17,17,134
16  510 DATA 16,0,0,0,0,17,16,17
    ,16,17,17,17,16,17,17,17,200
C9  520 DATA 16,17,17,17,16,17,1
    7,17,16,17,16,17,16,17,17,17
    ,267
78  530 DATA 16,17,16,17,16,17,1
    7,17,16,17,16,17,16,17,17,17
    ,266
73  540 DATA 16,17,16,17,16,17,1
    6,17,16,17,17,17,16,0,0,0,21
    5
A9  550 DATA 0,0,0,0,0,17,16,17,
    16,17,17,17,16,17,17,17,184
B1  560 DATA 16,17,17,17,16,17,1
    7,17,16,17,16,17,16,17,17,17
    ,267
83  570 DATA 16,17,16,17,16,17,1
    7,17,16,17,16,17,16,17,17,17
    ,266
DB  580 DATA 16,17,16,17,16,17,1
    6,17,16,17,17,17,16,0,0,0,21
    5
21  590 DATA 0,0,0,0,0,17,16,17,
    16,17,17,17,16,17,17,17,184
59  600 DATA 16,17,17,17,16,17,1
    7,17,16,17,16,17,16,17,17,17
    ,267
0B  610 DATA 16,17,16,17,16,17,1
    7,17,16,17,16,17,16,17,17,17
    ,266
43  620 DATA 16,17,16,17,16,17,1
    6,17,16,17,17,17,16,0,0,0,21
    5
D9  630 DATA 0,0,0,0,0,17,16,17,
    16,17,17,17,16,17,17,17,184
97  640 DATA 16,0,0,0,0,17,16,17
    ,16,17,17,17,16,17,17,17,200
C9  650 DATA 16,0,0,0,0,17,16,17
    ,16,17,17,17,16,17,17,17,200
5B  660 DATA 16,0,0,0,0,17,17,17
    ,17,17,17,17,17,17,17,17,203
9F  670 DATA 16,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,16
39  680 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
59  690 DATA 84,10,10,10,10,12,1
    2,12,12,10,10,10,10,14,14,14
    ,254
D7  700 DATA 14,10,10,10,10,14,1
    4,14,14,10,10,10,10,14,14,14
    ,192
06  710 DATA 14,10,10,10,10,12,1
    2,12,12,10,10,10,10,14,14,14
    ,184
CB  720 DATA 14,10,10,10,10,14,1
    4,14,14,10,10,10,10,14,14,14
    ,192
31  730 DATA 14,10,10,10,10,15,1
    5,15,15,10,10,10,10,16,16,16
    ,202
52  740 DATA 16,10,10,10,10,17,1
    7,17,17,10,10,10,10,18,18,18
    ,218
51  750 DATA 18,10,10,10,10,21,2
    1,21,21,10,10,10,10,23,23,23
    ,251
1F  760 DATA 23,21,21,21,21,21,2
    1,21,21,21,21,21,21,10,9,8,3
    02
05  770 DATA 7,7,7,7,7,16,16,16,
    16,7,7,7,7,16,16,16,175
B3  780 DATA 16,6,6,6,6,15,15,15
    ,15,5,5,5,5,14,14,14,162
53  790 DATA 14,11,11,11,11,15,1
    5,15,15,11,11,11,11,17,17,17
    ,213
B4  800 DATA 17,7,7,7,7,8,8,8,8,
    7,7,7,7,7,7,6,125
91  810 DATA 5,5,5,5,5,15,15,15,
    15,10,10,10,10,16,16,16,173
9D  820 DATA 16,10,10,10,10,17,1
    7,17,17,10,10,10,10,18,18,18
    ,218
54  830 DATA 18,10,10,10,10,21,2
    1,21,21,10,10,10,10,23,23,23
    ,251
67  840 DATA 23,21,21,21,21,21,2
    1,21,21,21,21,21,21,25,23,21
    ,344
6B  850 DATA 18,17,17,17,17,11,1
    1,11,11,11,11,11,11,23,21,19
    ,237
AC  860 DATA 17,15,15,15,15,10,1
    0,10,10,10,10,10,10,21,18,17
    ,213
5E  870 DATA 15,14,14,14,14,9,9,
    9,9,9,9,9,9,18,16,15,192
36  880 DATA 14,12,12,12,12,11,1
    1,11,11,21,21,21,21,21,21,21
    ,253
E3  890 DATA 21,21,21,21,21,0,0,
    0,0,0,0,0,0,0,0,0,105
3E  900 DATA 125,143,143,143,143
    ,143,143,143,143,143,143,143
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```
    ,143,24,24,24,1913
0E  910 DATA 24,143,143,143,143,
    239,239,239,239,143,143,143,
    143,24,24,24,2196
9A  920 DATA 24,143,143,143,143,
    143,143,143,143,143,143,143,
    143,24,24,24,1812
A2  930 DATA 24,143,143,143,143,
    239,239,239,239,143,143,143,
    143,24,24,24,2196
3A  940 DATA 24,143,143,143,143,
    210,210,210,210,143,143,143,
    143,195,195,195,2593
45  950 DATA 195,143,143,143,143
    ,195,195,195,195,143,143,143
    ,143,209,209,209,2746
13  960 DATA 209,143,143,143,143
    ,31,31,31,31,143,143,143,143
    ,181,181,181,2020
C1  970 DATA 181,31,31,31,31,31,
    31,31,31,31,31,31,31,143,104
    ,97,897
52  980 DATA 233,119,119,119,119
    ,195,195,195,195,12,12,12,12
    ,195,195,195,2122
8E  990 DATA 195,71,71,71,71,210
    ,210,210,210,237,237,237,237
    ,239,239,239,2984
76  1000 DATA 239,218,218,218,21
    8,210,210,210,210,218,218,21
    8,218,195,195,195,3408
F2  1010 DATA 195,233,233,233,23
    3,97,97,97,97,233,233,233,23
    3,233,12,71,2763
8F  1020 DATA 237,71,71,71,71,21
    0,210,210,210,143,143,143,14
    3,195,195,195,2518
02  1030 DATA 195,143,143,143,14
    3,195,195,195,195,143,143,14
    3,143,209,209,209,2746
9C  1040 DATA 209,143,143,143,14
    3,31,31,31,31,143,143,143,14
    3,181,181,181,2020
9B  1050 DATA 181,31,31,31,31,31
    ,31,31,31,31,31,31,31,30,181
    ,31,795
40  1060 DATA 209,195,195,195,19
    5,218,218,218,218,218,218,21
    8,218,181,31,239,3184
EB  1070 DATA 195,210,210,210,21
    0,143,143,143,143,143,143,14
    3,143,31,209,195,2614
B6  1080 DATA 210,24,24,24,24,10
    4,104,104,104,104,104,104,10
    4,209,195,210,1752
E3  1090 DATA 24,143,143,143,143
    ,218,218,218,218,31,31,31,31
    ,31,31,31,1685
FC  1100 DATA 31,31,31,31,31,0,0
    ,0,0,0,0,0,0,0,0,0,155
B7  1110 DATA 0,17,17,17,16,17,1
    7,17,16,17,17,17,16,17,17,17
    ,252
5F  1120 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
09  1130 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
43  1140 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
9D  1150 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
17  1160 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
C1  1170 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
31  1180 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,65,65,6
    5,412
37  1190 DATA 65,65,65,65,64,17,
    17,17,16,17,17,17,16,17,17,1
    7,509
EF  1200 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
59  1210 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
79  1220 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,65,65,6
    5,412
0F  1230 DATA 65,65,65,65,64,17,
    17,17,16,17,17,17,16,17,17,1
    7,509
67  1240 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
91  1250 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,17,17,1
    7,268
01  1260 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,65,65,6
    5,412
56  1270 DATA 65,65,65,65,64,17,
    17,17,17,17,17,17,16,65,65,6
    5,654
37  1280 DATA 65,65,65,65,64,17,
    17,17,17,17,17,17,16,65,65,6
    5,654
F9  1290 DATA 65,65,65,65,64,17,
    17,17,17,17,17,17,16,65,65,6
    5,654
35  1300 DATA 65,65,65,65,64,17,
    17,17,16,17,17,17,17,17,17,1
    7,510
1E  1310 DATA 16,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,16
8E  1320 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
C2  1330 DATA 21,21,21,21,21,15,
    15,15,15,15,15,15,15,16,16,1
    6,273
F2  1340 DATA 16,16,16,16,16,17,
    17,17,17,17,17,17,17,16,16,1
    6,264
7E  1350 DATA 18,16,16,16,16,15,
    15,15,15,15,15,15,15,16,16,1
    6,248
4E  1360 DATA 16,16,16,16,16,17,
    17,17,17,17,17,17,17,16,16,1
    6,264
C1  1370 DATA 16,16,16,16,16,12,
    12,12,12,12,12,12,12,14,14,1
    4,218
0C  1380 DATA 14,14,14,14,14,14,
    14,14,14,14,14,14,14,15,15,1
    5,227
C3  1390 DATA 15,15,15,15,15,17,
    17,17,17,17,17,17,17,39,39,3
    9,328
BF  1400 DATA 39,25,25,25,25,28,
    28,28,28,25,25,25,25,25,25,2
    5,426
75  1410 DATA 25,25,25,25,25,10,
    10,10,10,10,10,10,10,9,9,9,2
    32
1B  1420 DATA 9,47,47,47,47,42,4
    2,42,42,59,59,59,59,59,59,59
    ,778
F6  1430 DATA 59,53,53,53,53,53,
    53,53,53,47,47,47,47,47,47,4
    7,812
CF  1440 DATA 47,15,15,15,15,14,
    14,14,14,11,11,11,11,11,11,1
    1,240
DC  1450 DATA 11,11,11,11,11,12,
    12,12,12,12,12,12,12,14,14,1
    4,193
9C  1460 DATA 14,14,14,14,14,14,
    14,14,14,14,14,14,14,15,15,1
    5,227
D3  1470 DATA 15,15,15,15,15,17,
    17,17,17,17,17,17,17,39,39,3
    9,328
0F  1480 DATA 39,25,25,25,25,28,
    28,28,28,25,25,25,25,25,25,2
    5,426
66  1490 DATA 25,25,25,25,25,29,
    29,23,23,29,29,29,29,28,28,2
    8,429
F3  1500 DATA 28,28,28,28,28,26,
    26,21,21,26,26,26,26,25,25,2
    5,413
0C  1510 DATA 25,25,25,25,25,23,
    23,18,18,23,23,23,23,25,25,2
    5,374
01  1520 DATA 25,25,25,25,25,14,
    14,14,14,5,5,5,5,5,5,5,216
D0  1530 DATA 5,5,5,5,5,0,0,0,0,
    0,0,0,0,0,0,0,25
4E  1540 DATA 31,31,31,31,31,210
    ,210,210,210,210,210,210,210
    ,195,195,195,2420
67  1550 DATA 195,195,195,195,19
    5,195,195,195,195,195,195,19
    5,195,195,195,195,3120
D4  1560 DATA 195,195,195,195,19
    5,210,210,210,210,210,210,21
    0,210,195,195,195,3240
7B  1570 DATA 195,195,195,195,19
    5,195,195,195,195,195,195,19
    5,195,195,195,195,3120
A7  1580 DATA 195,195,195,195,19
    5,143,143,143,143,143,143,14
    3,143,24,24,24,2191
C6  1590 DATA 24,24,24,24,24,239
    ,239,239,239,239,239,239,239
    ,210,210,210,2662
02  1600 DATA 210,210,210,210,21
    0,195,195,195,195,195,195,19
    5,195,223,223,223,3279
29  1610 DATA 223,30,30,30,30,49
    ,49,49,49,30,30,30,30,30,30,
    30,749
E3  1620 DATA 30,30,30,30,30,143
    ,143,143,143,143,143,143,143
    ,247,247,247,2035
E8  1630 DATA 247,107,107,107,10
    7,62,62,62,62,190,190,190,19
    0,190,190,190,2253
31  1640 DATA 190,57,57,57,57,57
    ,57,57,57,107,107,107,107,10
    7,107,107,1395
A0  1650 DATA 107,210,210,210,21
    0,239,239,239,239,218,218,21
    8,218,218,218,218,3429
39  1660 DATA 218,218,218,218,21
    8,143,143,143,143,143,143,14
    3,143,24,24,24,2306
56  1670 DATA 24,24,24,24,24,239
    ,239,239,239,239,239,239,239
    ,210,210,210,2662
52  1680 DATA 210,210,210,210,21
    0,195,195,195,195,195,195,19
    5,195,223,223,223,3279
39  1690 DATA 223,30,30,30,30,49
    ,49,49,49,30,30,30,30,30,30,
    30,749
59  1700 DATA 30,30,30,30,30,223
    ,223,181,181,223,223,223,223
    ,49,49,49,1997
17  1710 DATA 49,49,49,49,49,156
    ,156,31,31,156,156,156,156,3
    0,30,30,1333
31  1720 DATA 30,30,30,30,30,181
    ,181,209,209,181,181,181,181
    ,30,30,30,1744
78  1730 DATA 30,30,30,30,30,24,
    24,24,24,71,71,71,71,71,71,7
    1,743
EC  1740 DATA 71,71,71,71,71,0,0
    ,0,0,0,0,0,0,0,0,0,355
38  1750 DATA 0,0,0,0,0,17,17,17
    ,16,0,0,0,0,17,17,17,118
E5  1760 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
EF  1770 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
65  1780 DATA 16,0,0,0,0,17,17,1
    7 16,0,0,0,0,17,17,17,134
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BB  1790 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
32  1800 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
60  1810 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
26  1820 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,0,0,0,2
    17
49  1830 DATA 0,0,0,0,0,17,17,17
    ,16,0,0,0,0,17,17,17,118
12  1840 DATA 16,17,17,17,16,17,
    17,17,16,17,16,17,16,17,17,1
    7,267
66  1850 DATA 16,17,16,17,16,17,
    17,17,16,17,16,17,16,17,17,1
    7,266
2E  1860 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,0,0,0,2
    17
71  1870 DATA 0,0,0,0,0,17,17,17
    ,16,0,0,0,0,17,17,17,118
42  1880 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
30  1890 DATA 16,0,0,0,0,17,17,1
    7,16,0,0,0,0,17,17,17,134
76  1900 DATA 16,17,17,17,16,17,
    17,17,16,17,17,17,16,0,0,0,2
    17
BC  1910 DATA 0,0,0,0,0,17,16,17
    ,16,17,17,17,16,17,17,17,184
7E  1920 DATA 16,0,0,0,0,17,16,1
    7,16,17,17,17,16,17,17,17,2C
    0
18  1930 DATA 16,0,0,0,0,17,16,1
    7,16,17,17,17,16,17,17,17,20
    0
96  1940 DATA 16,0,0,0,0,17,17,1
    7,16,17,17,17,17,17,17,17,20
    2
98  1950 DATA 16,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,16
3C  1960 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
7C  1970 DATA 173,255,204,240,6,
    206,255,204,76,188,204,169,4
    ,141,255,204,2784
EC  1980 DATA 169,15,141,24,212,
    169,9,141,5,212,169,57,141,6
    ,212,169,1851
AE  1990 DATA 10,141,12,212,169,
    56,141,13,212,169,9,141,19,2
    12,169,9,1694
43  2000 DATA 141,20,212,169,7,1
    41,10,212,169,128,141,9,212,
    173,80,193,2017
F4  2010 DATA,141,0,212,173,0,19
    2,141,1,212,173,160,194,141,
    4,212,173,2129
56  2020 DATA 80,197,141,7,212,1
    73,0,196,141,8,212,173,160,1
    98,141,11,2050
97  2030 DATA 212,173,80,201,141
    ,14,212,173,0,200,141,15,212
    ,173,160,202,2309
4A  2040 DATA 141,18,212,173,63,
    204,201,194,208,21,173,62,20
    4,201,152,208,2435
BE  2050 DATA 14,162,49,189,205,
    204,157,62,204,202,16,247,76
    ,182,204,162,2335
61  2060 DATA 0,32,196,204,162,6
    ,32,196,204,162,12,32,196,20
    4,162,18,1818
96  2070 DATA 32,196,204,162,24,
    32,196,204,162,30,32,196,204
    ,162,36,32,1904
AC  2080 DATA 196,204,162,42,32,
    196,204,162,48,32,196,204,16
    9,1,141,25,2014
96  2090 DATA 208,76,49,234,254,
    62,204,208,3,254,63,204,96,8
    0,193,141,2329
CF  2100 DATA 0,212,173,0,192,14
    1,1,212,173,160,194,141,4,21
    2,173,80,2068
48  2110 DATA 197,141,7,212,173,
    0,196,141,8,212,173,160,198,
    141,11,212,2182
F5  2120 DATA 173,80,201,141,14,
    212,173,0,200,141,15,212,173
    ,160,202,0,2097
CA  2130 DATA 120,169,31,141,13,
    220,141,13,221,173,13,220,17
    3,13,221,169,2051
CF  2140 DATA 0,141,20,3,169,204
    ,141,21,3,169,1,141,26,208,8
    8,96.1431
```

JOYSTICK CURSOR

PROGRAM: JOYCURS.SRC

THIS PROGRAM ONLY TO BE ENTERED
IF YOU ARE USING AN ASSEMBLER.

```
10 OPEN1,8,1,"JOYCURS.OBJ":SYS32768
20 .OPT P,O1:.SYM 2
30 ;
100 ;"
110 ;"
120 ;" JOYSTICK CURSOR V2.3
130 ;"
140 ;"    J. KEW, JAN 88
150 ;"
160 ;"   SOURCE CODE FOR
170 ;" ASSEMBLER/MONITOR 64
180 ;"
190 ;
200 *=$033C
210 INT = $0314
220 JV = $DC00
230 XMAX = $0289
240 BUFFL = $C6
250 KBUF = $0277
260 ;PLUS TBITZ, END OF PROG
290 ;
300 INIT   SEI              ;TOGGLE
310 :      LDA #<TBITZ      ;ROUTINE
320 :      EOR INT          ;ON/OFF
330 :      STA INT
340 :      LDA #>TBITZ
350 :      EOR INT+1
360 :      STA INT+1
370 :      CLI
380 :      RTS
390 ;
400 START LDA JV
410 :      AND #$1F       ;ISOLATE J/S BITS
420 :      TAY
430 :      LDA TAB,Y      ;LOAD CHARACTER
440 :      BEQ OUT1       ;FINISH IF NULL
450 :      CMP LASTC      ;COMPARE WITH LAST
460 :      BNE RESDL      ;IF DIFF, BRANCH
461 :      LDX RFLG       ;REPEAT FLAG
462 :      BNE DECDL      ;REPEAT ON
463 :      BEQ OUT
470 RESDL LDX #10        ;RESET DELAY
480 :      STX REPDL
490 :      BNE CHARP      ;JUMP
500 DECDL LDX REPDL
510 :      BEQ DECCT      ;IF DELAY=0
520 :      DEX            ;DECREMENT
530 :      STX REPDL
540 :      BEQ RESCT      ;IF DELAY NOW=0
550 :      BNE OUT        ;IF NOT, FINISH
560 DECCT DEC REPCT     ;DEC COUNTER
570 :      BNE OUT        ;IF NOT=0, FINISH
580 RESCT LDX #4        ;IF =0, RESET
590 :      STX REPCT
600 CHARP LDX BUFFL     ;PROCESS CHAR
610 :      CPX XMAX
620 :      BEQ OUT        ;IF FULL, FINISH
630 :      STA KBUF,X     ;STORE CHAR
640 :      INX            ;INC LENGTH
```

```
650 :      STX BUFFL
660 OUT1   STA LASTC
670 OUT    JMP $EA31   ;EXIT
690 ;
700 LASTC .BYT $00
710 REPCT .BYT $04
720 REPDL .BYT $0A
730 RFLG  .BYT $01
790 ;
800 ;            -   -   -   -   -  FSE
810 TAB .BYT $00,$00,$00,$00,$00,$00
820 ;
830 ;        FNE FE   -  FSW FNW FW
840 :    .BYT $00,$94,$00,$00,$00,$14
850 ;
860 ;              -  FS  FN  F   -   -
870 :    .BYT $00,$20,$0D,$00,$00,$00
880 ;
890 ;              -   -   -  SE  NE . E
900 :    .BYT $00,$00,$00,$1D,$1D,$1D
910 ;
920 ;              -  SW  NW  W   -   S
930 :    .BYT $00,$9D,$9D,$9D,$00,$11
940 ;
950 ;              N   -
960 :    .BYT $91,$00
970 ;
1000 TBITZ = START ↑ $EA31
```

PROGRAM: JOYCURS

```
6D  10 A=A+1:IFA=1THENLOAD"JOYCU
    RS.OBJ",8,1
28  20 SYS828
EB  30 POKE53280,0:POKE53281,0:P
    RINT"[CLR,DOWN,WHITE]";CHR$(
    14);TAB(13);"[SJ]OYSTICK[SC]
    URSOR"
B1  40 PRINTTAB(13)"[CT14]"
53  50 PRINT"[DOWN]";TAB(12);"[C
    8,SJ]. [SK]EW[SPC3,SJ]AN '88
    "
0D  60 PRINT"[DOWN3,RIGHT9,SU]SE
    A JOYSTICK IN PORT 2."
13  70 PRINT"[DOWN,RIGHT2,SS,SY,
    SS] 828[SPC4]: TOGGLES ROUTI
    NE ON/OFF."
DD  80 PRINT"[RIGHT2,SP,SO,SK,SE
    ] 922,1 : REPEAT JOYKEYS"
63  90 PRINT"[RIGHT2,SP,SO,SK,SE
    ] 922,0 : REPEAT OFF"
0E  100 PRINT"[DOWN,RIGHT2,SU]SE
    PROGRAM [SJ,SO,SY,SM,SO,SD]
     TO MODIFY ROUTINE."
E9  110 PRINT"[DOWN2,RIGHT5,SJ]O
    YSTICK CURSORING IS NOW [SO,
    SN]."
C5  120 PRINT"[DOWN3,C5,SPC10,SP
    ]RESS A KEY TO EXIT.[WHITE]"
1F  130 GETA$:IFA$=""THEN130
C6  140 PRINT"[CLR]"
```

PROGRAM: JOYMOD

```
6D  10 A=A+1:IFA=1THENLOAD"JOYCU
    RS.OBJ",8,1
5C  20 POKE53281,0:POKE53280,0:P
    RINTCHR$(142)"[WHITE]":GOSUB
    400:PRINT"[DOWN4]MODIFY (Y/N
    ) ?"
B2  30 GETA$:IFA$=""THEN30
B8  40 IFA$="N"THEN160
FD  50 IFA$<>"Y"THEN30
2A  60 FORN=1TO17:READDR$,DD$,P:
    GOSUB400
E3  70 PRINT"[HOME,DOWN4]";TAB(3
    0);"N[RIGHT,DOWN2]E[DOWN2,LE
    FT3]S[LEFT3,UP2]W[RIGHT]";DD
    $
15  80 PRINT"[HOME,DOWN10]PRESS
    KEY FOR DIRECTION OR ← FOR N
    ULL":PRINT"[DOWN]";DR$
BC  90 GETA$:IFA$=""THEN90
7D  100 POKE923+P,ASC(A$):NEXTN
24  110 GOSUB400:PRINT"[DOWN4]RE
    PEAT FLAG ON (Y/N) ?"
14  120 GETA$:IFA$=""THEN120
4B  130 RF=0:IFA$="Y"THENRF=1:GO
    TO160
DA  140 IFA$<>"N"THEN120
2E  150 POKE922,RF
81  160 GOSUB400
22  170 PRINT"[DOWN4]SAVE (Y/N)
    ?"
E2  180 GETA$:IFA$=""THEN180
32  190 IFA$="N"THEN230
61  200 IFA$<>"Y"THEN180
72  210 PRINT:INPUT"FILENAME ";F
    $
94  220 SYS57812F$,8,1:POKE193,6
    0:POKE194,3:POKE174,188:POKE
    175,3:SYS62957
EE  230 PRINT"[CLR]":END
8B  300 DATA"NORTH","[SW,UP,LEFT
    ,S-]",30,"NORTHEAST","[SW,UP
    ,SN]",22,"EAST","[SW,S*]",23
C1  310 DATA"SOUTHEAST","[SW,DOW
    N,SM]",21,"SOUTH","[SW,DOWN,
    LEFT,S-]",29,"SOUTHWEST","[S
    W,DOWN,LEFT2,SN]",25
15  320 DATA"WEST","[SW,LEFT2,S*
    ]",27,"NORTHWEST","[SW,UP,LE
    FT2,SM]",26,"FIRE","[SQ]",15
A0  330 DATA"FIRE+NORTH","[SQ,UP
    ,LEFT,S-]",14,"FIRE+NORTHEAS
    T","[SQ,UP,SN]",6,"FIRE+EAST
    ","[SQ,S*]",7
6B  340 DATA"FIRE+SOUTHEAST","[S
    Q,DOWN,SM]",5,"FIRE+SOUTH","
    [SQ,DOWN,LEFT,S-]",13
C1  350 DATA"FIRE+SOUTHWEST","[S
    Q,DOWN,LEFT2,SN]",9,"FIRE+WE
    ST","[SQ,LEFT2,S*]",11
15  360 DATA"FIRE+NORTHWEST","[S
    Q,UP,LEFT2,SM]",10
CB  400 PRINT"[CLR,DOWN]";TAB(9)
    ;"MODIFY JOYSTICK CURSOR"
9B  410 PRINTTAB(9)"[CY22]"
2B  420 RETURN
```

PROGRAM: JOYCURS.LOADER

```
86  10 BL=7:LN=50:SA=828
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
86  40 NEXT L
62  50 DATA 120,169,126,77,20,3,
    141,20,3,169,233,77,21,3,141
    ,21,1344
E8  60 DATA 3,88,96,173,0,220,41
    ,31,168,185,155,3,240,55,205
    ,151,1814
A3  70 DATA 3,208,7,174,154,3,20
    8,9,240,46,162,10,142,153,3,
    208,1730
DE  80 DATA 23,174,153,3,240,8,2
    02,142,153,3,240,7,208,26,20
    6,152,1940
A0  90 DATA 3,208,21,162,4,142,1
    52,3,166,198,236,137,2,240,9
    ,157,1840
B9  100 DATA 119,2,232,134,198,1
    41,151,3,76,49,234,0,4,10,1,
    0,1354
3D  110 DATA 0,0,0,0,0,0,148,0,0
    ,0,20,0,32,13,0,0,213
4E  120 DATA 0,0,0,0,29,29,29,0,
    157,157,157,0,17,145,0,0,720
88  130 PRINT "[CLR]THE DATA FOR
     JOYCURSOR IS NOW IN THE"
91  140 PRINT "CASSETTE BUFFER."
46  150 PRINT "IF YOU ARE A DISK
     USER THEN YOU CAN SAVE";
C0  160 PRINT "THE PROGRAM AS MA
    CHINE CODE BY TYPING"
34  170 PRINT" POKE 43,60:POKE44
    ,3:POKE45,188:POKE46,3"
3D  180 PRINT" CLR:SAVE"+CHR$(34
    )+"JOYCURS.OBJ"+CHR$(34)+",8
    "
29  190 PRINT"IF YOU ARE USING C
    ASSETTE THEN YOU WILL"
FE  200 PRINT"HAVE TO ADD THIS P
    ROGRAM TO ANY"
00  210 PRINT"PROGRAM THAT YOU W
    ISH TO USE JOYCURSOR"
55  220 PRINT"WITH. [RVSON]NOTE[
    RVSOFF] ANY CASSETTE LOAD OR
     SAVE"
BA  230 PRINT"WILL ERASE THE JOY
    CURSOR PROGRAM."
B1  240 PRINT " IF YOU KNOW HOW
    TO USE AN ASSEMBLER"
E4  250 PRINT "YOU COULD RELOCAT
    E THE MACHINE CODE TO "
B7  260 PRINT "ANOTHER ADDRESS B
    Y ENTERING THE"
5F  270 PRINT"ASSEMBLER RATHER T
    HAN THE BASIC LOADER."
20  280 PRINT" IF YOU DO NOT SAV
    E JOYCURS.OBJ THEN YOU";
58  290 PRINT"MUST DELETE THE LO
    AD INSTRUCTIONS FROM"
B2  300 PRINT"THE OTHER PROGRAMS
     FOR THIS ARTICLE AND"
D2  310 PRINT"MAKE SURE THAT YOU
     HAVE RUN THIS PROG."
E0  320 PRINT"BEFORE RUNNING THE
    M."
```

HI-RES FILL

PROGRAM: HI-RES FILL

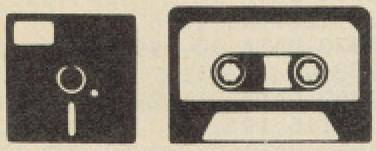
```
47  10 P=49152
69  20 READX:IFX=-1THENEND
4D  30 POKEP,X
BF  40 FORC=1TO7:READY:POKEP+C,Y
       :X=X+Y:NEXTC
77  50 READH:IFH<>XTHENPRINT"ERR
       OR IN LINE"PEEK(63)+PEEK(64)
       *256:END
95  60 P=P+8:GOTO20
D7  1000 DATA 169,57,141,24,208,
       173,2,221,995
8F  1010 DATA 9,3,141,2,221,169,
       148,141,834
FD  1020 DATA 0,221,169,204,141,
       136,2,173,1046
FF  1030 DATA 17,208,9,32,141,17
       ,208,96,728
85  1040 DATA 169,21,141,24,208,
       173,2,221,959
A7  1050 DATA 9,3,141,2,221,169,
       151,141,837
61  1060 DATA 0,221,169,4,141,13
       6,2,173,846
9D  1070 DATA 17,208,41,223,141,
       17,208,96,951
31  1080 DATA 169,0,162,224,133,
       251,134,252,1325
AF  1090 DATA 160,0,145,251,200,
       208,251,230,1445
70  1100 DATA 252,208,247,96,165
       ,20,24,41,1053
82  1110 DATA 248,121,112,192,13
       3,78,165,21,1070
1B  1120 DATA 121,137,192,133,79
       ,165,156,41,1024
77  1130 DATA 7,168,165,20,41,7,
       170,96,674
68  1140 DATA 0,64,128,192,0,64,
       128,192,768
76  1150 DATA 0,64,128,192,0,64,
       128,192,768
54  1160 DATA 0,64,128,192,0,64,
       128,192,768
2C  1170 DATA 0,224,225,226,227,
       229,230,231,1592
97  1180 DATA 232,234,235,236,23
       7,239,240,241,1894
CE  1190 DATA 242,244,245,246,24
       7,249,250,251,1974
A6  1200 DATA 252,254,128,64,32,
       16,8,4,758
98  1210 DATA 2,1,32,84,192,32,1
       9,193,555
E3  1220 DATA 189,162,192,17,78,
       145,78,32,893
C2  1230 DATA 36,193,96,32,84,19
       2,32,19,684
07  1240 DATA 193,189,162,192,73
       ,255,49,78,1191
BE  1250 DATA 145,78,32,36,193,9
       6,32,84,696
C0  1260 DATA 192,32,19,193,189,
       162,192,81,1060
F3  1270 DATA 78,145,78,32,36,19
       3,96,32,690
BB  1280 DATA 84,192,32,19,193,1
       89,162,192,1063
8A  1290 DATA 49,78,32,36,193,20
       1,0,96,685
7B  1300 DATA 56,169,199,229,155
       ,144,21,133,1106
1A  1310 DATA 156,74,74,74,168,1
       65,21,74,806
DF  1320 DATA 208,10,165,20,144,
       5,44,18,614
5B  1330 DATA 193,208,1,96,32,32
       ,192,76,830
2E  1340 DATA 72,178,192,72,173,
       14,220,41,962
D8  1350 DATA 254,141,14,220,165
       ,1,41,253,1089
B9  1360 DATA 133,1,104,96,72,16
       5,1,9,581
67  1370 DATA 2,133,1,173,14,220
       ,9,1,553
06  1380 DATA 141,14,220,104,96,
       32,253,174,1034
47  1390 DATA 32,235,183,134,155
       ,96,32,53,920
DF  1400 DATA 193,32,240,192,32,
       170,192,96,1147
D6  1410 DATA 32,53,193,32,240,1
       92,32,187,961
2E  1420 DATA 192,96,32,53,193,3
       2,240,192,1030
7D  1430 DATA 32,206,192,96,0,0,
       0,0,526
ED  1440 DATA 103,0,195,165,20,1
       66,21,141,811
3F  1450 DATA 96,193,142,97,193,
       165,155,141,1182
E2  1460 DATA 98,193,96,173,96,1
       93,174,97,1120
B8  1470 DATA 193,133,20,134,21,
       173,98,193,965
D3  1480 DATA 133,155,96,230,20,
       208,2,230,1074
F8  1490 DATA 21,96,165,20,208,2
       ,198,21,731
1C  1500 DATA 198,20,96,230,155,
       208,2,230,1139
61  1510 DATA 156,96,165,155,208
       ,2,198,156,1136
9D  1520 DATA 198,155,96,32,215,
       193,160,0,1049
50  1530 DATA 177,251,133,20,200
       ,177,251,133,1342
9E  1540 DATA 21,200,177,251,133
       ,155,200,145,1282
C7  1550 DATA 251,173,92,193,96,
       32,215,193,1245
74  1560 DATA 160,0,165,20,145,2
       51,200,165,1106
85  1570 DATA 21,145,251,200,165
       ,155,145,251,1333
BB  1580 DATA 200,173,92,193,145
       ,251,96,169,1319
6C  1590 DATA 0,162,200,133,251,
       134,252,174,1306
7F  1600 DATA 93,193,202,240,16,
       24,165,251,1184
A8  1610 DATA 105,4,133,251,165,
       252,105,0,1015
26  1620 DATA 133,252,76,226,193
       ,96,173,94,1243
A9  1630 DATA 193,16,43,32,99,19
       3,173,92,841
AC  1640 DATA 193,48,6,32,147,19
       3,76,12,707
4C  1650 DATA 194,32,154,193,165
       ,155,201,255,1349
A1  1660 DATA 240,66,201,200,240
       ,62,32,240,1281
40  1670 DATA 192,32,223,192,240
       ,54,169,0,1102
5E  1680 DATA 141,94,193,76,84,1
       94,32,99,913
A0  1690 DATA 193,173,92,193,48,
       6,32,147,884
E8  1700 DATA 193,76,55,194,32,1
       54,193,165,1062
AF  1710 DATA 155,201,255,240,23
       ,201,200,240,1515
33  1720 DATA 19,32,240,192,32,2
       23,192,208,1138
03  1730 DATA 11,169,128,141,94,
       193,238,93,1067
32  1740 DATA 193,32,189,193,32,
       115,193,173,1120
81  1750 DATA 95,193,16,43,32,99
       ,193,173,844
32  1760 DATA 92,193,16,6,32,147
       ,193,76,755
E9  1770 DATA 109,194,32,154,193
       ,165,155,201,1203
AE  1780 DATA 255,240,82,201,200
       ,240,78,32,1328
A1  1790 DATA 240,192,32,223,192
       ,240,70,169,1358
B9  1800 DATA 0,141,95,193,76,19
       7,194,32,928
74  1810 DATA 99,193,173,92,193,
       16,6,32,804
41  1820 DATA 147,193,76,152,194
       ,32,154,193,1141
49  1830 DATA 165,155,201,255,24
       0,39,201,200,1456
CD  1840 DATA 240,35,32,240,192,
       32,223,192,1186
D0  1850 DATA 208,27,169,128,141
       ,95,193,238,1199
8C  1860 DATA 93,193,173,92,193,
       73,128,141,1086
61  1870 DATA 92,193,32,189,193,
       173,92,193,1157
32  1880 DATA 73,128,141,92,193,
       32,115,193,967
BE  1890 DATA 96,32,53,193,32,20
       8,194,96,904
8E  1900 DATA 169,0,141,93,193,1
       41,92,193,1022
FC  1910 DATA 169,0,141,94,193,1
       41,95,193,1026
B0  1920 DATA 32,240,192,32,223,
       192,208,13,1132
E7  1930 DATA 32,138,193,165,20,
       37,21,201,807
1B  1940 DATA 255,240,2,208,235,
       32,131,193,1296
A2  1950 DATA 32,240,192,32,223,
       192,208,19,1138
47  1960 DATA 32,173,192,32,246,
       193,32,131,1031
32  1970 DATA 193,165,20,201,64,
       208,233,165,1249
DB  1980 DATA 21,240,229,173,93,
       193,240,19,1208
61  1990 DATA 32,163,193,206,93,
       193,32,240,1152
97  2000 DATA 192,32,223,192,240
       ,6,173,93,1151
83  2010 DATA 193,208,237,96,76,
       216,194,162,1382
CB  2020 DATA 0,160,204,134,78,1
       32,79,160,947
98  2030 DATA 0,145,78,200,208,2
       51,230,79,1191
5C  2040 DATA 166,79,224,208,208
       ,243,96,32,1256
C3  2050 DATA 253,174,32,158,183
       ,138,32,47,1017
AD  2060 DATA 195,96,32,53,193,3
       2,223,192,1016
75  2070 DATA 96,0,0,0,0,0,0,0,9
       6
E9  2080 DATA-1
```

PROGRAM: HI-RES DEMO

```
46  1 POKE53280,6+8
7B  2 DEFFNR1(X)=INT(RND(1)*264)+5
CE  3 DEFFNR2(X)=INT(RND(1)*144)+5
83  10 SYS49152:REM HIRES
49  11 PRINT"[CLR]"
BA  30 SYS49991,5:REM SET COLOUR
54  50 SYS49216:REM CLEAR GRAPHIC
41  60 FORD=0TO19
2C  70 O1=FNR1(0):O2=FNR2(0):GOSUB
       1000 SYS49184:REM LORES
16  80 NEXTD
```

```
C4  100 SYS49865,5,199-5:REM FILL
C0  110 POKE53280,5
0D  120 POKE198,0:WAIT198
.1:POKE198,0:
6A  999 END
10  1000 FORC=0TO50
41  1010 SYS49470,O1,O2+C:REM
PLOT
63  1020 SYS49470,O1+C,O2:REM
PLOT
21  1030 SYS49470,O1+C,O2+50:REM
PLOT
51  1040 SYS49470,O1+50,O2+C:REM
PLOT
DF  1050 NEXTC
A6  1060 RETURN
```

CODE RELOCATION



PROGRAM: CRELOC/BL

```
10 GOTO50000
20089 DATA 10,8,10,0,158,50,48,5
4
20097 DATA 49,0,0,0,32,68,229,16
2
20105 DATA 0,142,133,9,32,173,8,
174
20113 DATA 133,9,189,195,8,240,6
,32
20121 DATA 210,255,232,208,245,2
32,189,195
20129 DATA 8,208,230,32,207,255,
201,13
20137 DATA 208,249,160,0,185,2,5
,201
20145 DATA 48,176,8,201,7,176,39
,105
20153 DATA 9,208,7,56,233,48,201
,10
20161 DATA 176,28,192,1,240,10,1
0,10
20169 DATA 10,10,141,133,9,200,2
08,220
20177 DATA 13,133,9,141,129,9,16
9,0
20185 DATA 141,128,9,76,109,8,23
8,32
20193 DATA 208,76,13,8,234,169,1
36,133
20201 DATA 73,169,9,133,74,173,1
30,9
20209 DATA 133,75,173,131,9,133,
76,160
20217 DATA 0,162,0,177,73,205,13
2,9
20225 DATA 208,14,161,75,24,109,
129,9
20233 DATA 145,73,230,75,208,2,2
30,76
20241 DATA 200,208,2,230,74,204,
130,9
20249 DATA 208,225,165,74,205,13
1,9,208
20257 DATA 218,76,248,8,162,0,18
9,187
20265 DATA 8,240,6,32,210,255,23
2,208
20273 DATA 245,96,13,13,29,29,29
,29
20281 DATA 29,0,42,80,82,79,71,8
2
20289 DATA 65,77,32,82,69,76,79,
67
20297 DATA 65,84,79,82,42,0,76,6
9
20305 DATA 78,71,84,72,61,32,36,
48
20313 DATA 53,56,51,0,82,69,76,7
9
20321 DATA 67,65,84,69,32,84,79,
58
20329 DATA 36,67,48,48,48,0,0,16
9
20337 DATA 0,133,73,173,129,9,13
3,74
20345 DATA 169,136,133,75,169,9,
133,76
20353 DATA 160,0,177,75,145,73,2
30,73
20361 DATA 208,2,230,74,230,75,2
08,2
20369 DATA 230,76,165,75,205,130
,9,208
20377 DATA 233,165,76,205,131,9,
208,226
20385 DATA 32,173,8,162,0,189,95
,9
20393 DATA 240,6,32,210,255,232,
208,245
20401 DATA 32,228,255,240,251,20
1,89,240
20409 DATA 26,32,173,8,162,0,189
,111
20417 DATA 9,240,6,32,210,255,23
2,208
20425 DATA 245,174,128,9,173,129
,9,32
20433 DATA 205,189,96,108,128,9,
82,85
20441 DATA 78,32,78,79,87,63,32,
40
20449 DATA 89,47,78,41,32,0,83,8
9
20457 DATA 83,32,65,68,68,82,69,
83
20465 DATA 83,32,73,83,58,32,0,0
20473 DATA 0,11,15,19,0,0,0,76
20481 DATA 74,19,169,0,141,65,19
,173
20489 DATA 57,19,133,73,173,58,1
9,133
20497 DATA 74,160,0,177,73,205,6
5,19
20505 DATA 240,23,230,73,208,2,2
30,74
20513 DATA 165,73,205,59,19,208,
236,165
20521 DATA 74,205,60,19,208,229,
76,56
20529 DATA 19,238,65,19,208,209,
24,96
20537 DATA 0,192,16,192,16,192,0
,96
20545 DATA 0,173,57,19,133,73,13
3,75
20553 DATA 173,58,19,133,74,173,
64,19
20561 DATA 133,76,160,0,177,73,2
09,75
20569 DATA 240,3,32,129,19,200,2
08,4
20577 DATA 230,74,230,76,165,74,
205,60
20585 DATA 19,208,233,204,59,19,
208,228
20593 DATA 173,180,19,24,109,59,
19,141
20601 DATA 61,19,165,78,141,62,1
9,96
20609 DATA 173,179,19,208,13,238
,179,19
20617 DATA 173,59,19,133,77,173,
60,19
20625 DATA 133,78,177,73,72,173,
65,19
20633 DATA 145,73,140,181,19,104
,56,237
20641 DATA 58,19,172,180,19,145,
77,172
20649 DATA 181,19,238,180,19,208
,2,230
20657 DATA 78,96,0,0,0,162,0,189
20665 DATA 41,19,240,6,32,210,25
5,232
20673 DATA 208,245,96,169,147,32
,210,255
20681 DATA 162,0,142,181,19,32,1
82,19
20689 DATA 174,181,19,189,49,19,
240,6
20697 DATA 32,210,255,232,208,24
5,232,189
20705 DATA 49,19,208,230,96,169,
0,141
20713 DATA 39,19,162,6,142,40,19
,160
20721 DATA 25,24,32,240,255,32,2
07,255
20729 DATA 240,251,174,39,19,238
,39,19
20737 DATA 157,237,19,201,13,208
,238,174
20745 DATA 40,19,232,232,224,12,
144,220
20753 DATA 96,32,196,19,32,230,1
9,162
20761 DATA 88,32,203,19,32,228,2
55,240
20769 DATA 251,201,78,240,236,96
,0,0
20777 DATA 13,13,29,29,29,29,29,
0
20785 DATA 29,29,29,29,29,29,18,
65
20793 DATA 76,76,32,73,78,80,85,
84
20801 DATA 32,73,78,32,72,69,88,
146
20809 DATA 17,17,0,83,84,65,82,8
4
20817 DATA 32,79,70,32,65,83,83,
69
20825 DATA 77,66,76,89,49,58,0,8
3
20833 DATA 84,65,82,84,32,79,70,
32
20841 DATA 65,83,83,69,77,66,76,
89
20849 DATA 50,58,0,69,78,68,43,4
9
20857 DATA 32,79,70,32,65,83,83,
69
20865 DATA 77,66,76,89,49,58,0,0
20873 DATA 65,82,69,32,89,79,85,
32
20881 DATA 83,85,82,69,32,89,47,
78
20889 DATA 0,0,76,79,79,75,73,78
20897 DATA 71,32,70,79,82,32,77,
65
20905 DATA 82,75,69,82,0,0,77,65
20913 DATA 82,75,69,82,32,70,79,
85
20921 DATA 78,68,32,45,32,80,82,
69
20929 DATA 80,65,82,73,78,71,32,
80
20937 DATA 82,79,71,82,65,77,0,0
20945 DATA 77,65,82,75,69,82,32,
78
20953 DATA 79,84,32,70,79,85,78,
68
20961 DATA 32,45,32,69,88,73,84,
73
20969 DATA 78,71,0,0,65,66,67,68
20977 DATA 13,69,70,65,66,13,49,
50
20985 DATA 51,52,13,160,0,189,23
7,19
20993 DATA 232,201,13,240,246,20
1,64,176
21001 DATA 6,56,233,48,76,18,19,
233
```

```
21009 DATA 55,192,1,240,6,141,66
,19
21017 DATA 200,208,226,14,66,19,
14,66
21025 DATA 19,14,66,19,14,66,19,
13
21033 DATA 66,19,96,162,0,160,0,
140
21041 DATA 67,19,32,252,19,172,6
7,19
21049 DATA 153,68,19,200,192,6,2
08,239
21057 DATA 96,0,0,0,0,0,0,0
21065 DATA 0,216,32,18,19,32,44,
19
21073 DATA 32,121,19,32,68,229,1
62,106
21081 DATA 32,203,19,32,3,19,176
,6
21089 DATA 162,160,32,203,19,96,
162,126
21097 DATA 32,203,19,32,66,19,32
,220
21105 DATA 19,32,158,19,32,59,19
,96
21113 DATA 173,69,19,141,57,19,1
73,68
21121 DATA 19,141,58,19,173,71,1
9,141
21129 DATA 63,19,173,70,19,141,6
4,19
21137 DATA 173,73,19,141,59,19,1
73,72
21145 DATA 19,141,60,19,96,173,5
7,19
21153 DATA 160,0,56,233,135,133,
73,141
21161 DATA 248,19,173,58,19,233,
1,133
21169 DATA 74,141,249,19,169,250
,133,75
21177 DATA 169,19,133,76,177,75,
145,73
21185 DATA 230,73,208,2,230,74,2
30,75
21193 DATA 208,2,230,76,165,74,2
05,58
21201 DATA 19,208,233,165,73,205
,57,19
21209 DATA 208,226,96,173,59,19,
56,237
21217 DATA 57,19,141,57,19,173,6
0,19
21225 DATA 237,58,19,141,58,19,1
69,136
21233 DATA 24,109,57,19,141,123,
19,169
21241 DATA 9,109,58,19,141,124,1
9,162
21249 DATA 0,173,58,19,41,240,74
,74
21257 DATA 74,74,24,105,48,201,5
8,144
21265 DATA 3,24,105,7,157,217,19
,232
21273 DATA 224,4,240,21,224,1,20
8,8
21281 DATA 173,58,19,41,15,76,11
,19
21289 DATA 173,57,19,224,2,240,2
13,208
21297 DATA 242,173,65,19,141,125
,19,96
21305 DATA 0,0,162,0,189,199,19,
240
21313 DATA 6,32,210,255,232,208,
245,162
21321 DATA 0,32,207,255,240,251,
201,13
21329 DATA 240,8,157,183,19,232,
224,13
21337 DATA 208,239,224,0,240,220
,142,197
21345 DATA 19,162,0,189,221,19,2
40,6
21353 DATA 32,210,255,232,208,24
5,32,207
21361 DATA 255,240,251,201,13,24
0,5,141
21369 DATA 198,19,208,242,173,19
8,19,56
21377 DATA 233,48,201,1,240,4,20
1,8
21385 DATA 208,176,170,169,1,160
,0,32
21393 DATA 186,255,173,197,19,16
2,183,160
21401 DATA 19,32,189,255,173,248
,19,133
21409 DATA 73,173,249,19,133,74,
169,73
21417 DATA 174,61,19,172,62,19,2
32,208
21425 DATA 1,200,32,216,255,96,3
2,32
21433 DATA 32,32,32,32,32,32,32,
32
21441 DATA 32,32,32,32,0,0,13,17
21449 DATA 17,17,17,29,29,80,82,
79
21457 DATA 71,82,65,77,32,78,65,
77
21465 DATA 69,58,32,0,13,17,17,2
9
21473 DATA 29,79,85,84,80,85,84,
32
21481 DATA 68,69,86,73,67,69,32,
40
21489 DATA 49,47,56,41,58,32,0,0
21497 DATA 0,10,8,10,0,158,50,48
21505 DATA 54,49,0,0,0,32,68,229
21513 DATA 162,0,142,133,9,32,17
3,8
21521 DATA 174,133,9,189,195,8,2
40,6
21529 DATA 32,210,255,232,208,24
5,232,189
21537 DATA 195,8,208,230,32,207,
255,201
21545 DATA 13,208,249,160,0,185,
2,5
21553 DATA 201,48,176,8,201,7,17
6,39
21561 DATA 105,9,208,7,56,233,48
,201
21569 DATA 10,176,28,192,1,240,1
0,10
21577 DATA 10,10,10,141,133,9,20
0,208
21585 DATA 220,13,133,9,141,129,
9,169
21593 DATA 0,141,128,9,76,109,8,
238
21601 DATA 32,208,76,13,8,234,16
9,136
21609 DATA 133,73,169,9,133,74,1
73,130
21617 DATA 9,133,75,173,131,9,13
3,76
21625 DATA 160,0,162,0,177,73,20
5,132
21633 DATA 9,208,14,161,75,24,10
9,129
21641 DATA 9,145,73,230,75,208,2
,230
21649 DATA 76,200,208,2,230,74,2
04,130
21657 DATA 9,208,225,165,74,205,
131,9
21665 DATA 208,218,76,248,8,162,
0,189
21673 DATA 187,8,240,6,32,210,25
5,232
21681 DATA 208,245,96,13,13,29,2
9,29
21689 DATA 29,29,0,42,80,82,79,7
1
21697 DATA 82,65,77,32,82,69,76,
79
21705 DATA 67,65,84,79,82,42,0,7
6
21713 DATA 69,78,71,84,72,61,32,
36
21721 DATA 48,52,48,48,0,82,69,7
6
21729 DATA 79,67,65,84,69,32,84,
79
21737 DATA 58,36,67,48,48,48,0,0
21745 DATA 169,0,133,73,173,129,
9,133
21753 DATA 74,169,136,133,75,169
,9,133
21761 DATA 76,160,0,177,75,145,7
3,230
21769 DATA 73,208,2,230,74,230,7
5,208
21777 DATA 2,230,76,165,75,205,1
30,9
21785 DATA 208,233,165,76,205,13
1,9,208
21793 DATA 226,32,173,8,162,0,18
9,95
21801 DATA 9,240,6,32,210,255,23
2,208
21809 DATA 245,32,228,255,240,25
1,201,89
21817 DATA 240,26,32,173,8,162,0
,189
21825 DATA 111,9,240,6,32,210,25
5,232
21833 DATA 208,245,174,128,9,173
,129,9
21841 DATA 32,205,189,96,108,128
,9,82
21849 DATA 85,78,32,78,79,87,63,
32
21857 DATA 40,89,47,78,41,32,0,8
3
21865 DATA 89,83,32,65,68,68,82,
69
21873 DATA 83,83,32,73,83,58,32,
0
21881 DATA 0,0,0,0,0,0,0,0
21889 DATA 247,247,2,0,0,0,0,0
21897 DATA 0,0,0,0,0,0,0,0
21905 DATA 0,0,0,0,0,0,0,0
21913 DATA 0,0,0,0,0,0,0,1
21921 DATA 0,0,0,1,1,1,1,1
21929 DATA 1,1,1,0,0,0,1,2
21937 DATA 2,2,2,2,2,2,2,1
21945 DATA 2,2,1,2,2,0,0,0
21953 DATA 0,0,2,2,3,2,0,2
21961 DATA 0,2,0,2,0,2,0,2
21969 DATA 0,0,3,0,3,3,0,0
21977 DATA 0,0,3,0,0,3,3,5
21985 DATA 3,5,3,4,3,3,3,0
21993 DATA 5,3,3,3,3,3,3,3
22001 DATA 3,3,3,0,0,0,256
50000 M=2049:PRINT"(CLR)(DOWN)(D
OWN)(RGHT)(RGHT)(RGHT)(RVS)LOCAT
ION:(OFF)"
50010 FORL=0TO1:L=0
50020 READV:IFV=256THENL=1:GOTO5
0050
50030 POKEM,V:PRINT"(HOME)(DOWN)
(DOWN)(RGHT)(RGHT)(RGHT)(RGHT)(R
GHT)(RGHT)(RGHT)(RGHT)(RGHT)(RGH
T)(RGHT)(RGHT)";M
50040 M=M+1
50050 NEXT
50060 INPUT"(CLR)(DOWN)(DOWN)(DO
WN)(RGHT)(RGHT)FILENAME";F$
50070 INPUT"(DOWN)(DOWN)(RGHT)(R
GHT)TAPE(T)/DISC(D)";O$
50080 IFF$=""ORO$<>"T"ANDO$<>"D"
THEN50060
50085 O=1*ABS(O$="T")+8*ABS(O$="
D")
50090 PRINT"(CLR)(DOWN)(DOWN)SAV
E"CHR$(34);F$;CHR$(34);",";O
50094 H=INT(M/256):L=M-H*256:POK
E252,L:POKE253,H
50095 POKE46,PEEK(253):POKE45,PE
EK(252)
50100 POKE631,13:POKE198,1:PRINT
"".
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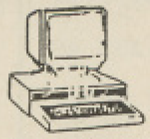
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Tel: 0952 620 488

Ask for Pauline

Why not include your business details in our Specialists Repairs Guide.

Ring Alan Cole on 01-437 0699 or fill in the details of your business (opposite) and we will contact you.

Our address is on the classified pages.

Your Commodore — Specialist Repairs Guide — Please contact me from the details below:-

Name ....

Company ....

Address ....

Tel. No. ....

B R E A K

Bug Finder

We'd like to remind our readers that we run a Bug Finder service.

If you have typed in one of our programs and despite much checking, you still can't get it to run, then send us the following:

Two copies of your program on tape or disk.
A description of your problem.
If possible a listing of your work (you may omit this).
A stamped, self-addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

Do not send a program to us as soon as it stops working, please check it several times first.

We do get a large number of queries and so it may take a while for us to deal with yours personally.

Note: we can only deal with problems relating to programs published in *Your Commodore*.

At the *Your Commodore* office we receive hundreds of letters from readers every month. We do try and answer each individually but sometimes this is impossible due to pressure of work. If you have written to us and not received a personal reply, we apologise for this but we cannot promise to reply to every item of mail we receive. If you feel that your question or letter really needs an answer, then inclusion of an s.a.e. will guarantee a reply, although this may still take time to arrive.

Commodore Where Are You?

At the *Your Commodore* office we are repeatedly asked for the address and telephone number of Commodore U.K. Many people, after referring to their computer manuals, believe them to be based in Corby.

The Commodore plant at Corby was closed down some time ago. Reproduced here you will find the correct address for Commodore U.K.

We suggest that you write this correct address in the front of your computers manual for future reference.

Commodore Business Machine, (UK),
Commodore House,
The Switchback,
Gardner Road,
Maidenhead,
Berks SL6 7XA.

Competition Winners

At last the eagerly awaited result of the **Micronet** competition which we ran in the May issue. And the winner of the highly acclaimed ProPak which comprises the Telemap modem and software is Bruce Belton of Henfield, Sussex. Congratulations Bruce!

We have a Scottish winner for the June **Board Game** competition. Brian Graham of Ayr wins The Colossus Series which comprises Chess, Bridge and Maj Jong. The ten runners up will each receive a Maj Jong set – read on and see if it's you;

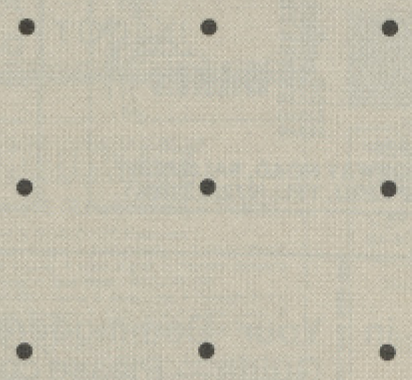
David Fairweather, Blackburn; A. Betesta, Derby; M.R. Eyres, Co. Galway; P. Moisejeus, Swindon; K. Patel, Crawley; Allan Parker, Huntingdon; G. Patel, Surrey; Dixie Dean, Littlehampton; J. Hicks, Redditch; Dave Parish, West Wickham.

The three lucky winners of the **Graphics** competition which we ran in the July issue are Michael Suchoruczka, Nottingham; M. Moore, Ipswich; J. Davey, Torquay. They will all receive a graphics package comprising Photo Finish, BillBoard Maker, Icon Factory, Screen F/X and Clipart from Financial Systems Software. The seven runners up will each receive a copy of the popular F/X package. They are: R.H. Underwood, Surbiton; Eugene Morgan, C. Down; A. Haddon, Nottingham; G.G. Brown, Tyne & Wear; M.J. New, Canterbury; Sean Whelan, Plumstead; G. Snowling, Sudbury.

Puzzle Corner

PUZZLE CORNER

Another simple one this month. Imagine that there are nine dots arranged in a 3 x 3 grid (see diagram).



All you have to do is join all the dots using just four straight lines. The only snag is that each new line must start where the old one finishes.

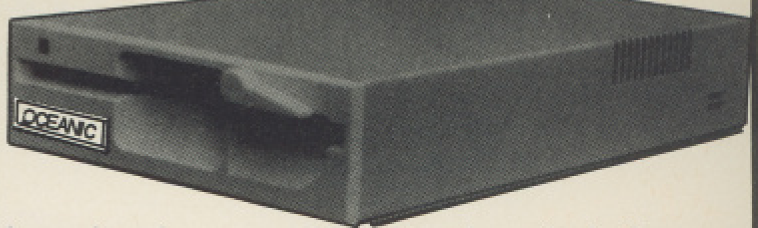
Send entries to, *Grid Puzzle*, Your Commodore, A.S.P. Ltd, 1 Golden Square, London W1R 3AB.

Evesham Micros

All prices include VAT/delivery

OCEANIC OC-118

Previously sold as 'Excelerator Plus'



A superb package representing extremely good value for money, combining the Oceanic OC-118 disk drive (previously sold as 'Excelerator+') and the sophisticated GEOS system. Said by COMPUTE's Gazette to have "dramatic improvements over the 1541 in quality and reliability", the drive is a stylish and attractive compact unit featuring a direct drive motor and its own external power supply. GEOS brings the power of a graphic interface and integrated disk turbo to your '64 and includes geoPAINT, a graphic workshop, geoWRITE, a WYSIWIG word processor and many Desk Accessories. Many more extensions available - see below.

Oceanic OC-118 & GEOS £129.95

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GEOWRITE WORKSHOP	£24.95	GEOCALC 128	£32.95
FONTPACK+ 64/128	£16.95	GEOFILE 128	£32.95
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star LC-10

Best-selling CBM ready printer

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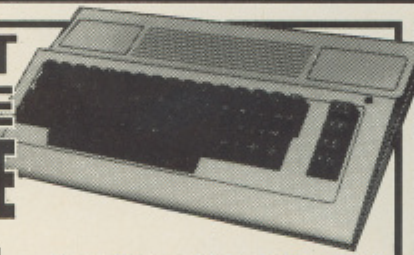
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Utility disc only £7.95



Selected Products

LOAD IT!! ...... The best thing to happen to a Commodore data recorder. Includes built-in azimuth adjustment knob and LED tape signal level meter **£39.95**

DOUBLER '64 ...... Makes perfect tape backups every time. Consists of hardware and software. Requires access to two data recorders. Very easy to use, only **£12.95**

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DOLPHIN DOS ...... Parallel operating system for use with 64/128 and 1541 disk drive. Fantastic speed increase on LOAD and SAVE whilst maintaining CBM disk format. Many extra DOS & BASIC commands, includes built-in monitor and Centronics printer driver **£69.95**

DISC DISECTOR V5.0 ...... Disk backup/utility package featuring wide range of powerful programs. Compatible with 64/128/128D and 1541/1570 disk drives **£19.95**

1541 PHYSICAL EXAM ...... Consists of digital alignment disk and drive fault diagnosis software to check and correct 1541 head alignment. Includes quiet drive stops **£39.95**

1541 QUIET DRIVE STOPS ...... Silences 'knocking' noise with 1541 drives (not suitable for 'turn lever' type drives) **£4.95**

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AZIMATE 3000 KIT ...... Tape loading problems? Use this kit to check and adjust data recorder head alignment **£6.95**

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AMIGA 500 .... **£389.00**
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YOUR
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OCTOBER 1988

IRREGULAR ADD-ONS
a round-up of unusual access

Games Reviewed:
- Dark Side
- Football Manager II
- The Games—Winter Edition
- Netherworld
- Fernandex Must Die



Alarm—programmer's time out

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